THE RAILWAY REVIEW

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Working in Compressed Air.—E. W. Moir, in a paper read before a recent meeting of the Society of Arts, gave some interesting data regarding the effects upon the human system of working in compressed air, and the various practical means of lessening the danger and overcoming any sudden collapses. Mr. Moir had charge of the work on the Hudson River tunnel for a time, and has had some connection with most of the underground tunneling ventures of the past two decades. He says: "When I first came to New York the men had been dying at the rate of one man per month out of 45 or 50 men employed, a death rate of about 25 per cent per annum. With a view to improving this state of things, an air compartment like a boiler was made, in which the men could be treated homœpathically, or reimmersed in compressed air. It was erected near the top of the shaft, and when a man was overcome or paralyzed, as I have seen them often, completely unconscious and unable to use their limbs. they were carried into the compartment and the air pressure raised to about one-half or two-thirds of that in which they had been working with immediate improvement. The pressure was then lowered at a very slow rate of one pound per minute, or even less.the time allowed for equalization being from 25 to 30 minutes, and even, in severe cases, the men went away quite cured. Every man should be medically examined, and hot coffee should be given to each man before he comes out of compressed air. A warm room to dress in and extra clothing for passage through the lock should be supplied. At the Blackwall tunnel,with the experience gained and attention to the above points, we have not had a single death, notwithstanding the fact that we had men working under a pressure of 37 lbs. per square inch for some time. Generally sparely built men not too full blooded, are those who stand air pressure best. A man with weak lungs may work and improve, bnt one with a weak heart or any apoplectic tendency should not go in at all. Drink of all classes is bad, but such drinks as tend to thicken the blood are worse than spirits."

Wire and Cut Nails.—The Sibley Journal of Mechanical Engineering gives the results of some experiments to determine the comparative holding power of wire and cut nails. The tests were made on pieces of white pine,joined with simple lap joints fastened by the nails. These were subjected to transverse stresses, in some cases parallel to the axes of the nails, in others at right angles. When the load was applied perpendicular to the nails, the wood was often split and the cut nails were often broken, while the wire nail joints were broken by bending and drawing the nails. When the load was applied in the direction in which the nails were driven, the joints were broken by nails being drawn almost without being bent. Under this same manner of loading, the nails were started by smaller loads than the cut nails, yet when the cut nails were started they yielded rapidly, while the wire nails held nearly as well as at first. In all the cases tried the cut nails were found superior in strength and rigidity, while in one-half the cases wire nails gave the joints greater resilience than the cut nails.

Corrosion from Coal Tar.—At a recent meeting of the Nottingham section of the Society of Chemical Industry, Mr. F. J. R. Carulla exhibited some specimens of corroded bolts which he had found under circumstances which seemed to show that the active corrosive agent was some constituent of ordinary coal or gas tar. As this substance is extensively used for the protection of iron surfaces exposed to the weather, its possibilities for corrosion are important. The samples exhibited were certainly peculiar. The bolts had been used in connection with a pump in a well, and from the evidence obtained there appears little doubt that the corrosive agent had its origin in tar residues which were known to exist on the surface, and by leakage communicated their influence to the water. That gas tar may occasionally prove a destructive rather than protective agent for iron surfaces has been pointed out before, though it is not generally known, and, as Mr. Carulla remarks, says the Practical Engineer, cases could be cited where gasholders had been seriously damaged through coating it with raw tar. It would appear that the active corrosive agent is chiefly carbolic acid, though it is satisfactory to know that it can be easily prevented by heating it with two or three per cent of lime in order to neutralize the acid. As this acid, however, is one of the best protective agents for wood, it would seem that the best plan for protecting a composite structure, such as a railway wagon, is to first coat the iron work with tar that has been heated with lime, and in which the carbolic acid has been neutralized, and afterwards to coat the wooden framework with raw tar.

Difficulty of Chinese Telegraphy.—According to the "Statesman's Year Book," all the principal cities of China are connected with one another and with Pekin, the capital, by telegraph. Recent visitors to China say, however, that telegraphing there is a laborious and expensive process. The Chinese have no alphabet, and their literary characters number many thousands, so it is simply impossible to invent sufficient signals to cover the written language. This difficulty was obviated by inventing a telegraphic signal for each of the cardinal numbers, and so numbers or figures might be telegraphed to any extent. Then a code dictionary was prepared, in which each number from 1 up to several thousands stood for a particular Chinese letter or ideograph. It is, in fact a cipher system. The sender of the message need not bother himself about its meaning. It is very different with the receiver. He has the code dictionary at his elbow, and after each message is received he must translate it, writing ea h literary character in place of that numeral that stands for it. Only about an eighth of the words in the written language appear in the code, but there are enough of them for all practical purposes. Men of ordinary education have not sufficient acquaintance with the written language to be competent telegraph receivers, and the literati are not seeking employment in telegraph offices any more than our college professors are. So the government recruits its employes with much difficulty. There is another great disadvantage in the Chinese telegraph system. All over the world the movement of railroad trains are regulated by telegraph. Railroads have been introduced into China to a very small extent, and there is talk of greatly extending the service. But how about running the trains? The Chinese goverment will not take foreigners into its service, and the educated men of China, who alone among the people have sufficient knowledge of the written language to be intrusted with the actual running of trains, would refuse most emphatically to be either train hands or station agents.

Traffic via the "Soo" Canal.—Comparative statement of commerce east and west bound through St. Mary's Falls canal, Michigan, for month of July, 1896:

EAST BOUND.

Items.	Designation.	U. S. Canal	Can. Canal	Total.
Copper	Net tons.	17,155	2,104	19,259
Grain	Bushels.	927,433	365,079	2,292,512
Building stone.	Net tons.	4,225		4,225
Flour	Barrels	765,833	323,384	1,089,217
Iron ore	Net tons	815,961	723,562	1,539,523
Iron, pig	Net tons	4,967	1,115	6,082
Lumber	M. ft. B. M.	111,733	5,062	116,795
Silver ore	Net tons			
Wheat	Bushels.	2,798,206	4,037,835	6,836,041
Unclass'd frt.	Net tons	31,511	8,485	39,996
Passengers	Number.	3,220	1,975	5,195

WEST BOUND.

Items.	Designation.	U. S. Canal	Can. Canal	Total.
Coal (hard)	Net tons.	28,610	11,500	40,110
Coal (soft)	Net tons.	223,418	246,975	470,393
Flour	Barrels			
Grain	Bushels.			
Manuf'd iron.	Net tons.	14,590	3,330	17,920
Salt	Barrels	26,207	4,135	30,342
Unclass'd frt.	Net tons	30,824	11,628	42,452
Passengers	Number.	2,792	2,768	5,560

East bound freight, net tons	2,152,953
West bound freight, net tons	574,916
Total	2,727,869
Total craft—United States	2,215
Total craft—Canadian	1,202
	3,417
Total registered tonnage—United States	1,855,060
Total registered tonnage—Canadian	1,074,675
	2,929,755

Effect of Cheap Steel on the Iron Industry.—Sir Henry Bessemer and Sir William Siemens have been reproached with inventing and introducing processes that have practically ruined the manufactured iron industry of this country. To a large extent this has no doubt been the case. The production of wrought iron during the last fifteen years has dropped from 2¾ to 1 1-5 million tons, while the production of steel has more than doubled. But even this movement, revolutionary and disastrous as it has been, has not been unattended with its compensations. The basic process of steelmaking is now largely carried on by the aid of puddler's tap, which would otherwise have been a waste product, but which is now eagerly bought by basic steel manufacturers. It is usual to employ from 50 to 70 per cent of puddler's tap per ton of basic iron produced in the blast furnace. This substance usually contains from 45 to 55 per cent of iron, and from 3 to 6 per cent of phosphorus, and it is the latter mettaloid, otherwise not only useless but deleterious, that chiefly makes the product valuable. It is the presence of the large reserves of puddler's tap in Staffordshire, etc., that has enabled the pig iron trade in these districts to be kept alive when it would otherwise, by the exhaustion of cheap local ironstone, have been doomed to certain annihilation.

Working to the Drawing.—A French blacksmith was once employed by a writer in Digest of Physical Tests to make some very intricate work, large and small, for a special machine then in progress of construction. One of the plain pieces was a shaft 20 feet long with collars welded on. The drawing showed a break between collars, because of its length. This puzzled the man considerably, for he knew strict orders had been given him to make it like the drawing. Not having been used to drawings, and having a reverential respect for obedience,he broke it like the drawing, mumbling at the time semi-familiar French adjectives. When the writer returned, after a brief days' absence, to note the progress made, he saw an expression on the blacksmith's face ever to be remembered, and which needed no explanation as to its cause. He was one of nature's finest workmen, and had he followed his own ideas, neither he nor the shaft would have had a break.

Peculiar Engineering Problem in India.—An unusua problem was last year presented to the civil engineers in the public works department in India in the preparation of a valley containing several villages for inevitable destruction by a flood. A landslide at Gohna, in the northwest provinces, formed a natural dam-across the valley of the Bireh Ganga, which rose about 900 ft. above the bed of the stream. A lake commenced to form behind this bank, and it was evident that the dam would be submerged finally, steps had to be taken to secure life and as much valuable property as possible in the valley below. The lake was rising so rapidly that there was not enough time to cut a breach through the dam, and it was necessary to let things take their natural course. A telegraph line was constructed from the lake to the various villages lower down in the valley and substantial monuments were erected along the sides of the valley above the anticipated high water mark, to which the inhabitants were ordered to proceed immediately on the announcement by telegraph of the breakage of the reservoir. At the same time all permanent bridges except two which were allowed to remain on the demand of the local authorities were taken down and replaced by temporary rope bridges. Careful surveys were made of the lake, in order to determine about the day on which failure was to be expected, and the estimate was only ten days in error, very close work in view of the enormous volume of the impounded water, which was estimated at 16,650,000,000 cubic feet. The valley immediately below the dam has an average slope of 250 ft. to the mile, so the opportunities for destructive results were very good. The failure occurred about midnight, a breach of 390 ft. deep through the barrier. The flood swept away whole villages, the abutments of the bridges which had been removed, and scoured the valley clean, but owing to the precautions taken not a single life was lost. The average velocity of the flood wave was 26 ft. per second for a distance of 72 miles, and the maximum velocity was 40 ft. per second. The depth of the torrent was about 260 ft. in the gorge, immediately below the dam and 160 ft. some further down. The hight and velocity were obtained by noticing the time when lanterns were swept away which had been placed at known elevations along the sides of the valley.

Responsibility for "Tornado" Repairs.—The tornado at St. Louis has raised an interesting question regarding the limits of responsibility under the Master Car Builders' rules of interchange, says the American Engineer, Car Builder & Railroad Journal. These rules say that cars must be returned in as good running order as when received, and the various roads signing the code have agreed to do this. But when property is destroyed by what is in legal phraseology termed an "act of God" the courts will not compel the payment of damages. Some of the roads entering St. Louis were willing to repair at their own cost foreign cars on their tracks damaged by the tornado, while others refused to do so. Some of those refusing did so on the ground that while they might be willing to pay the costs in this case if others signing the code of rules would do likewise in the future, there was no guarantee that such costs could be collected in this or in future cases, nor was there any redress obtainable by taking a future case into the courts. In other words, while the framers of the code of rules might not have so meant it, these rules go further than does the law and involve obligations not recognized in the courts; hence a settlement of this case under the rules would not be fair to the parties interested unless they were assured that in the future the rules would not be repudiated and the protection of the courts sought by those on whom the obligations would fall. There was to be a meeting held in July of those interested at St. Louis to decide upon the course to be pursued but at this writing we have not learned the results of the conference.

Engineering Tools at Pompeii.—Under the title of "Things of Engineering Interest Found at Pompeii," Professor Goodman gave his inaugural lecture in the engineering department of the Yorkshire College, Leeds. The lecturer remarked that he had recently visited Pompeii, and was not only charmed by the great beauty of the works of the ancient Romans, but also by their extreme ingenuity as mechanics—in fact,it was a marvel how some of the instruments and tools they were in the habit of using could possibly have been made without such machinery as we now possess. After explaining the situation and destruction of Pompeii by showers of ashes and mud, not lava, as is usually supposed, in the year 79 A.D., Prof. Goodman showed a series of about fifty lantern slides, prepared from photographs taken by himself in Pompeii last Easter. The streets, he explained, were used as waterways to carry off the surface water, and probably sewage, from the houses. The pavements were raised about a foot above the streets, and stepping stones were provided at intervals for foot passengers. The horses and chariots had to pass between, and in many places deep ruts had been worn by the chariot wheels in the stone paved streets. The water supply of Pompeii was distributed by means of lead pipes laid under the streets. There were many public drinking fountains, and most of the large houses were provided with fountains, many of most beautiful design. The ampitheater, although a fine structure, capable of seating 15,500 people, was small compared with many in Italy. The bronzes found at Pompeii revealed great skill and artistic talent. The bronze brazier and kitchener were provided with boilers at the side and taps for running off the hot water. Ewers and urns have been discovered with internal tubes and furnaces precisely similar to the arrangement now in modern steam boilers. Several very strong metal safes provided with substantial locks have been found. The locks and keys

are most ingenious and some very complex. On looking at the iron tools found in Pompeii one could almost imagine he was gazing into a modern tool shop, except for the fact that the ancient representatives have suffered severely from rust. Sickles, bill-hooks, rakes, forks, axes, spades, blacksmith's tongs, hammers, soldering irons, planes, shovels, etc., are remarkably like those used to-day; but certainly the most marvelous instruments found are the surgical instruments, beautifully executed, and of design exactly similar to some recently patented and reinvented. Incredible as it may appear, yet it is a fact, that the Pompeiians had wire ropes of perfect construction.—[Age of Steel.

THE POOLING OF FREIGHT EQUIPMENT.*

There is probably not a road in our association but what at some time during the past few years has seen a period when it has simply been impossible to obtain cars to handle the business offering. These conditions were not caused by lack of equipment in the country, but by the existing methods of handling cars. There is to-day at least 25 per cent more freight cars than are necessary to move the largest volume of traffic we have ever been called on to care for. At no time do we find every section of our vast country in want of some class of cars simultaneously; but under the present system there is no provision for moving the surplus equipment from one section to another.

There are in the United States, Canada and Mexico over 1,175,000 freight cars owned by railway companies, representing an investment of about $580,000,000, which has not for years earned enough to pay the interest on the investment, depreciation and repairs.

The question arises—"What can we do to increase the performance of our cars?"

Plan after plan has been suggested; roads have kept on building cars, but with no apparent relief. The only remedy is the general pooling of all freight cars, the adoption of per diem, a uniform standard in sizes of cars, and the full enforcement of car service.

Referring to the proceedings of the eastern railway car service officers in September, 1894, we find the following resolution:

"Resolved, That a general distributing office or clearing house, with subsidiary bureaus, be established for the purpose of regulating and increasing the supply of cars between railroads to meet the legitimate demands of traffic."

Again on page 12 of the proceedings of the nineteenth annual convention of car accountants—"If an adequate performance of freight equipment is ever to be secured, it can only be through a radical change of system."

I believe that the time is not far distant when we have got to come to a general distributing office, or something of the kind. A few contend that it is "too large a subject," "too many conflicting interests to harmonize," etc. The same remarks were made by many of our most prominent railway men when the Joint Traffic Association was suggested, but it came, is here, and apparently to stay.

There has been too much selfishness in the past which has resulted in disaster to the majority. We must unite now on some plan that will stop the enormous leaks caused by

1. Idle equipment in one part of the country while another part is suffering for the same identical cars.

2. The handling of empty cars of similar class in contrary directions on account of route or initials.

3. The switching of empties out of sidings, freight houses, etc., only to switch in the same class of cars to load via lines other than those owning the cars switched out.

4. Unnecessary switching to get some particular car out of a string of empties, when the first car is exactly the same kind of a car but with other initials.

5. The expense of traveling car agents, car tracing clerks and car service associations. (The latter will be merged into district bureaus.)

As an illustration, take the sleeping car companies. Were all contracts to be annuled to-morrow between them and the railway companies twice the number of sleeping cars now in service would not care for the current business, making no provision for equipment needed during large conventions, gatherings, etc.

Take the private stock car companies. No railway company can show up any such average mileage per car per day. While railroad companies average 35 to 50 miles the private car companies run 75 to 100. You see a string of their cars in Montana to-day, at the seaboard in a few days, and a week later away down in Texas or Mexico. Their cars are always in active service because handled by one central authority to meet the requirements of the various sections.

In forming a car pool or equipment company I would recommend that we start in with the box cars first, because that class of cars is in more general demand and in 90 per cent of the cases represents the item of equipment from which we receive most complaints of shortage.

With a view of economy in painting, clerical work, car recording, accounting, etc., I would recommend something after the following plan:

1. Have a distinctive mark to represent the class of car, thus:

"A," for box cars.
"B," stable stock cars.
"C," common stock cars, single deck.
"D," common stock cars, double deck.
"E," commercial horse cars.
"F," palace horse cars.
"G," gondola coal cars.
"H," hopper bottom.
"J," drop bottom.
"K," side dump.
"L," flats, common.
"M," ore cars, etc.

Classify length same way, viz.:

Under 32 ft.	"A"	Under 35 ft.	"E"
" 32 ft.	"B"	" 36 ft.	"F"
" 33 ft.	"C"	" 37 ft.	"G" etc
" 34 ft.	"D"		

Capacity to be designated in a similar manner:

Under 30,000 lbs.	"A"	Under 60,000 lbs.	"E"
" 30,000 lbs.	"B"	" 70,000 lbs.	"F"
" 40,000 lbs.	"C"	" 80,000 lbs.	"G" etc
" 50,000 lbs.	"D"		

Abolish all car initials and use the distinctive letters instead.

Each kind commence at 1 and number up, thus: A box car 34 feet long (inside) 60,000 lbs. capacity, would simply be marked "A D E," 5,910. In a short time every switchman, bill clerk, auditor's clerk, car distributer, record clerk and employe or shipper would know at a glance what a car was. There would be no necessity of consulting a guide. Instead of reporting a dozen or more initials on car reports, we would simply use the "pool" marks. In many cases this would reduce the number of initials to report over 70 per cent.

In box cars alone the guide shows over 630,000, at an approximate valuation of over $310,000,000, and distributed as to lengths as follows:

20 ft.	long		275	36 ft.	long		15,057
22 "	"		33	37 "	"		2,393
23 "	"		84	38 "	"		1,339
24 "	"		995	39 "	"		957
25 "	"		478	40 "	"		5,157
26 "	"		514	41 "	"		150
27 "	"		36,615	42 "	"		158
28 "	"		97,668	44 "	"		15
29 "	"		39,658	45 "	"		31
30 "	"		54,743	46 "	"		55
31 "	"		1,338	47 "	"		2
32 "	"		30,242	49 "	"		2
33 "	"		134,311	52 "	"		14
34 "	"		200,533				
35 "	"		7,079				
							630,176

The first step necessary to form a pool (after the roads have agreed to it) is the establishment of a general or central office in charge of a general manager. Then divide the country into districts, similar to or in conformity with the freight traffic associations, such as eastern, central, etc., each district to be in charge of a district manager or distributor; each road to handle its own distribution as at present; daily reports to be rendered to the district office, which, in turn, consolidates and transmits the same to the central office.

The pool would have to be organized by each road taking as much stock in the equipment company as the valuation of its equipment amounted to, each company to receive its pro-rata earnings as each class of cars it owns in the pool bears to the total number of cars or valuation of that class: Thus all 34 ft. box cars, 50,000 capacity would be marked "A D D." If the L. S. & M. S. Ry. own 11 per cent of the valuation of all cars in that class, they would receive 11 per cent of the earnings.

If such a thing is necessary the identity of the cars can be preserved by assigning each road's cars of the same class into consecutive series or numbers: Thus, C. C. C. & St. L. Ry., 34 ft., 30 ton box cars 18,000 to 18,999 would be assigned "A D E" 1 to "A D E" 1,000; N. Y. C. & H. R., 52,000 to 55,999 would be assigned "A D E" 1,001 to "A D E" 5,000, etc.

Each road in the pool will be entitled to the same number of cars in each class as it owns in the pool, providing it needs them, and must accept up to its quota when offered for storage.

Compensation should be based on both the earning capacity of car and per diem, if possible. Thus:

30 ton and over, per diem 30 cents, or ⅜ cent per mile.
25 ton and over, per diem 25 cents, or ½ cent per mile.
20 ton and over, per diem 20 cents, or ⅜ cent per mile.
15 ton and over, per diem 15 cents, or ¼ cent per mile.
Under 15 tons, per diem 10 cents, or ⅛ cent per mile.

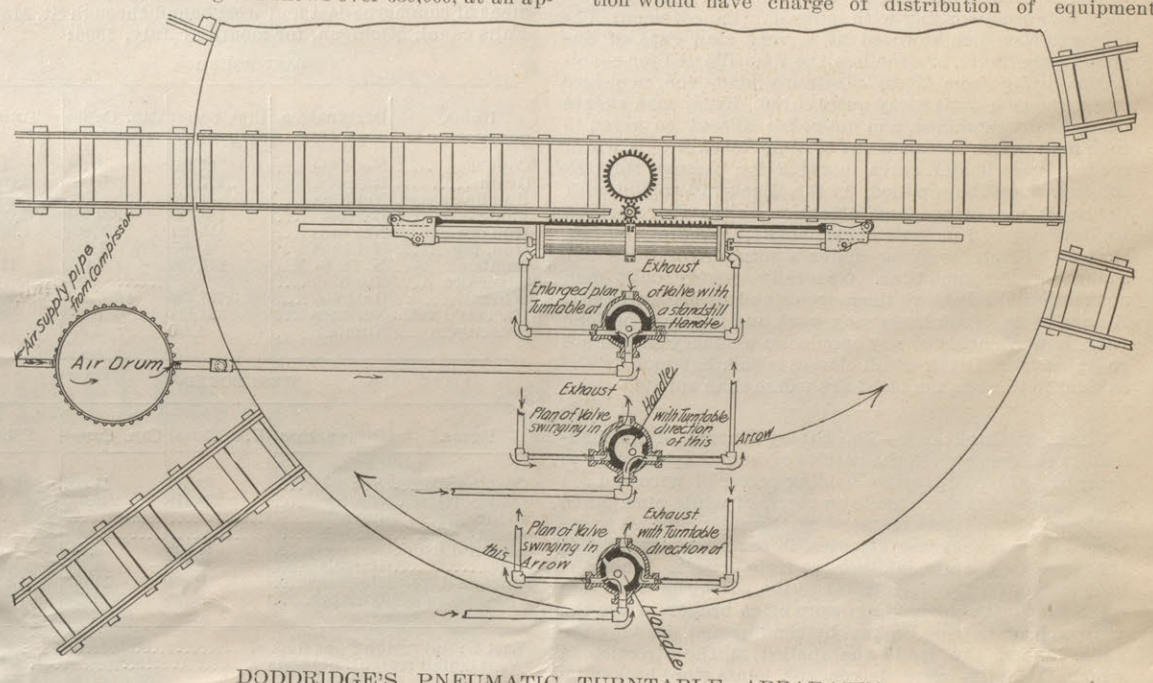
For all cars in excess of 39 feet add an agreed per cent.

By graduated compensation as suggested above, in addition to the justness of the proposition, roads would use only such cars as are necessary to handle the business. Thus, a road that could use ¼ cent cars would not call for ⅝ cent cars, allowing the latter to go into such service as the ¼ cent equipment would be incapable of handling.

Car repairs could be based on proportion of mileage or per diem, or on such basis as may be agreed upon by M. C. B.'s of lines interested. This means uniform standards sooner than under present methods. The car pool means decreased expenses from

1. The increased performance of all cars, permitting the handling of a given quantity of business with a minimum number of cars—obviating the building of any new equipment for five or six years.
2. Decrease in empty and foreign mileage.
3. Saving in switching at terminals and stations.
4. Reduction in train mileage.
5. Decrease in inspectors, repair shops, material, maintenance of way, car repairs, wheelage or trackage over foreign rails, clerical work, telegraphing, etc.
6. Increased earnings from greater supply of cars and reduction in expenses.

The district manager for the Joint Equipment Association would have charge of distribution of equipment



DODDRIDGE'S PNEUMATIC TURNTABLE APPARATUS.

handling of demurrage or car service matters, car repairs and all matters pertaining to the equipment. This would be an improvement over present methods, for the reason that the car owner would have a representative at every point seeing that the best service was given out of the equipment, while under present conditions at many points foreign equipment is abused, misused and held on account of being a "wanderer from home".

After the box cars have got to working in the pool, then add stock or other classes as fast as considered advisable or as the trustees representing the owners may decide on.

The difficulties to be overcome are not as great as might appear upon first consideration of the subject, as an organization can be formed by which all roads desiring to become members (stockholders) would be protected equitably in their rights.

Last fall I took the trouble to inquire about the probable loss to railroads from cars lying idle at junction points, and transfer stations, being transferred, waiting transfer switching, etc. Replies were received from a number of representative men. The lowest estimate showed from loss of revenue, cost of transfer, and loss in car mileage for one year over $25,000,000, and the above simply on account of owners not allowing their cars to go beyond junction point.

*Read before the Association of Railway Officials at Toledo, O., July 21, 1896, by J. R. Cavanagh, of the C., C., C. & St. L. Ry.

PNEUMATIC POWER APPLIED TO TURNTABLES.

The list of functions to which pneumatic power is applied is continually growing, one of the most recent additions being the rotation of turntables. A design of apparatus for this purpose has been made by Mr. W. B. Doddridge, general manager of the Missouri Pacific system by whom the device has been patented and placed in the hands of the American Air Power Co., of 160 Broadway, New York. A skeleton diagram of the apparatus is shown in the accompanying illustration. The apparatus may be applied to any design of turntable by a modification of the pit for the reception of the air cylinders and rods. The center of the table is surrounded by a spur gear wheel which is attached to the table and revolves with it. Into this gear a pinion meshes which receives its motion from a rack of sufficient length to revolve the large pinion completely. This rack is attached to and carried between two cross-

heads which are mounted upon guide bars and receive their motion from the piston rods of two long air cylinders placed with their back heads butting together. Air pressure is admitted to either of these cylinders or they are put into communication with the exhaust according to the position of the controling valve which is shown in section in three positions.

The valve is of the plug type and has four ports, one controling the exhaust and the others governing the admission of air to either or both of the cylinders. When the valve is in the normal position both cylinders are under pressure and the table is stationary. It is held positively even in case of leakage of one of the pistons. The movement in either direction is governed by the position of the handle as shown in the diagram, the direction of rotation being indicated by the arrows. The apparatus is simple and may be constructed in such a way as not to be liable to derangement or to excessive wear. There are but two glands and one plug valve to be kept tight and these may be made so as to be easily accessible. The fact that the cylinders are stationary and that no expansion or swivel joints are required in the air pipes is a good feature and with correct methods of designing the apparatus would seem to promise entirely satisfactory results.

THE NIPPON RAILROAD OF JAPAN.*

It is only about thirty years since what we call "New Japan" began its existence. In only one generation the Mikado's empire has made unparalleled progress in civilization and in the adoption of western manners and customs. Doubtless railroads have been one great factor of this wonderful progress in Japan. The opening of the Yokohama line, completed in 1871, may be regarded as the first railway in Japan, and is operated by the government. At that time the line ran from Tokio to Yokohama, a distance of 18 miles. It now extends to Kyoto, the western capital of the empire, 330 miles. The journey from Tokio to Kyoto is made in nineteen hours, at an expense of $3.30, third class. By the old system of "Kago" traveling the trip required some seventeen days, at a cost of $25. Thus the railway system has reduced the time and fare about one-tenth.

I well remember an instance, in my own experience, of the old time methods of traveling. In January, 1869, the second year of the Restoration, the change in the political affairs made it necessary for us to remove from Tokio to Kyoto, a distance of 330 miles, as above mentioned. We left Tokio with three "kagos" and seven coolies. A "kago," I may explain, is like a large basket suspended on poles, that are supported on the shoulders of the coolies. The largest "kago," in which my grandmother rode, required the service of three coolies; the others were carried by two each. The party consisted of grandfather, grandmother, parents, young brother and myself. On the first day we journeyed 18 miles; on the second, 14. On the 3d of February we reached the ferry of the Oigawa river, which rises in Mount Fuji, and were compelled to stop a day, owing to the high water. On the twelfth day we reached Nagoya, a distance of 235 miles. Five days after this we arrived in Kyoto, where we were glad to be released from the wearisome confinement of our "kagos." This journey required seventeen days and cost about $150. To-day the same party could make such a journey in two days at a cost of $15 in a comfortable train, though not so elegant as the "Empire State Express." What a wonderful change! We ought indeed to be thankful to the genius of the great Stephenson.

There is another line in Japan, which is owned and operated by a private company—the Nippon Railroad Company. It is one of the pioneer railways in this country, and is now a very popular route for pleasure seekers. Sixteen years ago a charter was granted by the government to the Nippon Railroad Company to build a railroad through the northeastern part of Japan. On July 27, 1883, the first line between Tokio and Kumagaye was opened—a distance of 38 miles. Since then a branch road from Omiya to Utsnomiya, a distance of 49 miles, has been added. In 1891 the Mito Railroad, which was operated some 50 miles, was taken into this system. At present the main line operated is 603 miles, having 200 miles under construction.

The capital stock of the company is $30,000,000. Ten per cent regular dividends have been paid during past years. We have a branch line to Nikko, the world-renowned place of resort, a distance of 90 miles from Tokio. This is a very profitable line, and earned 14 per cent dividends last year. On this section the traffic is only passengers, the majority of whom are pleasure seekers and visitors to the Temple. We have 130 engines and 1,900 cars, of which 1,500 are freight cars. There are 130 daily movements of trains, which makes a mileage of 12,000 miles. During the past six months we carried 3,800,000 passengers, and freight amounting to 1,000,000 tons over the system. Total earnings were $2,200,000, of which $1,200,000 were from passengers. The operating expense was only $870,000, leaving a net balance of $1,330,000 for dividends.

About 6,000 men are employed, of whom 100 are officers, 1,000 clerks, 600 station masters and operators, 500 engineers, firemen and 1.600 trackmen. The remainder are laborers and coolies. The management of the road is carried on by a board of twelve directors, who are elected for a term of two years. Officers and clerks receive salaries ranging from $200 to $9,000 per year. Those of the train and station service receive $180 to $900 per year. A relief fund system was instituted about a year ago, from which we have already had very good results.

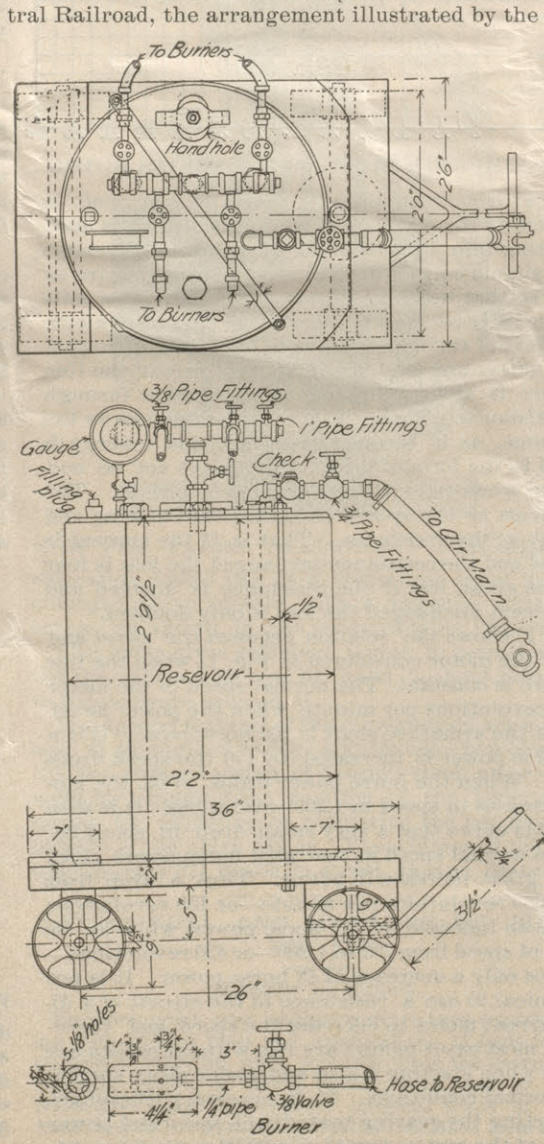
We have profited much by the many excellent examples which the western nations have placed before us. In a word, our company is the New York Central of Japan. We have taken many lessons from the New York Central of America, and I am indeed much indebted to the officers of that company who received me so kindly when I was in New York a few years ago, and wish to take this opportunity of expressing my sincere thanks to them.

Tokio, June 7, 1896.

*By R. Unno, traffic manager Nippon Railroad, in New York Railroad Men.

CARBURETTOR FOR PAINT BURNING.

The idea of using gasoline carburettors and burners for burning paint off of passenger coaches is not new, nearly every large car shop being supplied with apparatus for this purpose. The usual equipment consists of a small tank or reservoir containing gasoline. These reservoirs are seldom large enough to supply more than one or two burners. During a recent visit to the Burnside shops of the Illinois Central Railroad, the arrangement illustrated by the accompanying engraving attracted attention as being constructed upon a scale which would permit of reducing the expense of burning off cars to a point below that reached where smaller carburettors are used. The one illustrated is shown to be fitted with four hose connections. Four more have been added since the drawing was made, which increases the capacity of the machine to eight burners. The hose connections are made of sufficient length to admit of burning off one car or several cars standing on adjacent tracks.



CARBURETTOR FOR PAINT BURNING—I. C. R R.

The air pressure is regulated by throttling by means of the globe valve in the connection to the main air pipe and the air admission pipe passes down through the gasoline through which it bubbles and becomes charged with the vapor. The dimensions of the tank and the truck on which it is mounted are given in the illustration, which also shows the construction of the burner. The cost of burning off a passenger car, the standard of this road, by this apparatus is $4.50, as stated last week, this including 70 cents, the cost of the gasoline. It is interesting to note that the cost of burning off cars has been brought down from $20 with the hand torches to the figure given above by the introduction of improvements in the carburetting devices. The cost of burning off refrigerators has been reduced from $5 to $1.75. The work is now performed by men paid at the rate of 15 cents per hour, which explains a portion of the advantage which has been gained in the cost of this work.

Thousand Mile Railway Tickets in England.

The North-Eastern Railway Company seems to have tentatively decided to adopt Artemus Ward's motto—"You can't go in without paying, but you can pay without going in." In arranging to issue at reduced rates books of coupons available for twelve months over the whole of the North-Eastern system, and for journeys amounting in the aggregate to 1,000 miles, the directors are practically saying to the world at large: "You can't travel without paying your fare, but you can pay your fare without traveling." If the purchaser of a book of coupons succeeds in using the whole number he will have secured 1,000 miles of first-class railway travel at an average fare of 1¼d. per mile. The idea will doubtless prove attractive to many who, like Mrs. Gilpin, have a frugal mind; but it is never likely to achieve any wide popularity while it remains hedged about with restrictions so numerous and so irritating as those which official ingenuity has devised for the North-Eastern "new departure." The coupons are not, it seems, to be directly available as tickets; they must be exchanged at the booking office for the ordinary ticket before the journey begins. Nor will it be sufficient to produce to the booking clerk the exact number of coupons representing the distance to be traveled. The book itself must be produced for his inspection, and its proud possessor will resemble no one so much as the irascible old lady of the comic papers who carried about a huge family bible under her arm in order to convince incredulous booking clerks that her son was under twelve years of age. Probably these regulations are intended to preserve the legend of non-transferability, but the North-Eastern, in issuing these coupons, is going so far in the direction of making railway tickets transferable that it is difficult to discern any logical reason for not going the rest of the way. The coupons, it is expressly stated, may be used, not only by the purchaser but by members of his family and guests. If the tickets purchased by "A" are to be available for use by his son, his daughter, his manservant, his maidservant, his ox, his ass, and the stranger that is within his gates, why should "B," who happens to fall under none of these fortunate categories, be debarred from using them? It will obviously be impossible to exercise any discrimination between people who have at one time or other been guests of the purchaser of a coupon book and people who have not been so favored. Thus, to all intents and purposes, the coupons will be freely transferable. Bentham somewhere points out that nothing is more derogatory to the lawgiver than to make laws which are incapable of enforcement. What is true of laws in general is true of railway bye-laws in particular, and to swear by all one's gods that tickets shall be non-transferable, while relaxing the regulations to such an extent as to render the detection of coupon transfer a practical impossibility, is at best a futile proceeding. The new system which the North Eastern Co. but introduced is admittedly only in the experimental stage, but if it proves successful there is no reason why it should be limited to first class passengers or to journeys exceeding 10 miles in length. Jack is as good as his master now-a-days, and third-class travelers will soon assert their claim to "a reduction on taking a quantity." The tramway and omnibus companies, which have experimented in a similar fashion, have not, we understand, found any great desire on the part of the public to buy tickets in advance. The harmless necessary penny demanded as the price of a 'bus ride hurts nobody's pocket, while the sovereign or so required to purchase tickets on a large scale is a serious matter for the great majority of the 'bus riding public. Whether things are differ-

nt in the railway world remains to be seen. For our own part, much as we admire the enterprise of the North Eastern Railway Co. in initiating the change, we shrewdly doubt whether any large section of the public is anxious to pay five guineas for the privilege of traveling a thousand miles on the North Eastern system. As Punch remarked, *apropos* of the injunction not to marry one's grandmother, "Who on earth wants to?"—[Railway Times.

SPEED, POWER AND EFFICIENCY OF ELECTRIC MOTORS FOR LOCOMOTIVES.*

D. L. BARNES.

The striking simplicity of the fundamental principles which govern the action of that class of electric motors most used for locomotives was the origin of the suggestion which led to the preparation of this paper. Railroad motors are nearly all of the plain direct current series type. All the windings on the motor field coils are in series with the main circuit wires and all of the main current passes through them. The current is called "direct" because it flows continuously in one direction. The letters "D. C." are used to signify such a current and a D. C. motor is a direct current motor. Alternating current motors are signified by the "A. C." For shop work D. C. motors are generally "shunt" wound, and sometimes, but not often, "compound" wound; in the latter case the field coils are wound with a fine wire, through which a small part of the current goes, and with a large wire through which most of the current passes. The data given in this paper does not relate to the shunt wound motors, but solely to the plain simple series motor now so commonly used in preference to the other varieties of direct current motors for railway use.

The windings on the common series motor are very simple. Sometimes there are but two poles and again there are six. Often the consequent pole type is used, especially for railroad work. Two of the poles are wound with wire, but the others have no coils around them. They are called the "consequent poles," their magnetism being "induced" by the wire on the other poles. This shape of motor is better adapted for use on trucks, as the width is less than for any other type. One side of the motor is close to the axle, while the other is near the transom of the truck, so that with this shape the wheel base of the truck need not be greatly increased to admit of a large motor.

The wiring of armatures varies greatly with different builders of motors, but all have the same fundamental plan; namely, to provide paths for the electric current to pass around the armature and magnetize it. Generally railroad and shop motors have but two brushes, and the electric current goes in at one brush and then divides into two parts and passes around the armature in two separate paths which join again at the other brush.

Direct current series motors are usually built for armature speeds not exceeding 1,200 revolutions per minute as a maximum, and whatever be the use to which a motor is put the armature speed should not be allowed to exceed the limit specified by the makers. This is the maximum speed; the normal rated speed is much less. A fair statement of common practice is about 800 revolutions per minute for an 100 horse power motor when generating 100 horse power. The maximum speed is from 1,200 to 1,500 revolutions per minute, according to the strength of the binding wires or clamps that hold the armature coils from flying out of the grooves in the armatures. The centrifugal force of the revolving coils is considerable.

To a railroad man accustomed to the great uncertainties of the action of steam locomotives and the inaccuracy and incompleteness of the data and formulæ relating to their power and efficiency, the beautiful simplicity and accuracy of the data giving the action of direct current electric motors under variable speeds and loads is pleasing and attractive. To show the relation of speed, load and efficiency of direct current electric motors is the principal object of this paper.

Each design of electric motor as it is built is tested for its speed, power and efficiency and also for the heating during a long run. The results are plotted and form a set of characteristic curves such as that given by Fig. 1. These curves show how the motor will act when connected to an electric current having a pressure of 500 volts. The shape of the curves shows the character of the relation between the current in amperes going into the motor and the speed, power and efficiency. The basis of these curves is the current flowing into the motor. In railroad work the most useful basis is the speed, and the characteristic curves given in Fig. 1 have been transformed to a speed basis and are given in what follows.

*Abstract of a paper read before the Western Railway Club.

One interesting feature of the direct current motor is that it will always run at a fixed speed for each given load, and cannot be made to run above or below that speed without changing the line pressure. An increase in the line pressure will make the motor run faster. There are several ways of arranging the winding on the pole pieces so that some of the wire coils can be cut out of the circuit, and several ways of permitting part of the current to be passed by the fields instead of through them, all of which weaken the magnetism of the poles and allow the motor to run at a higher speed with the same line pressure.

The plan which is commonly employed to reduce the speed below the fixed or natural speed of the

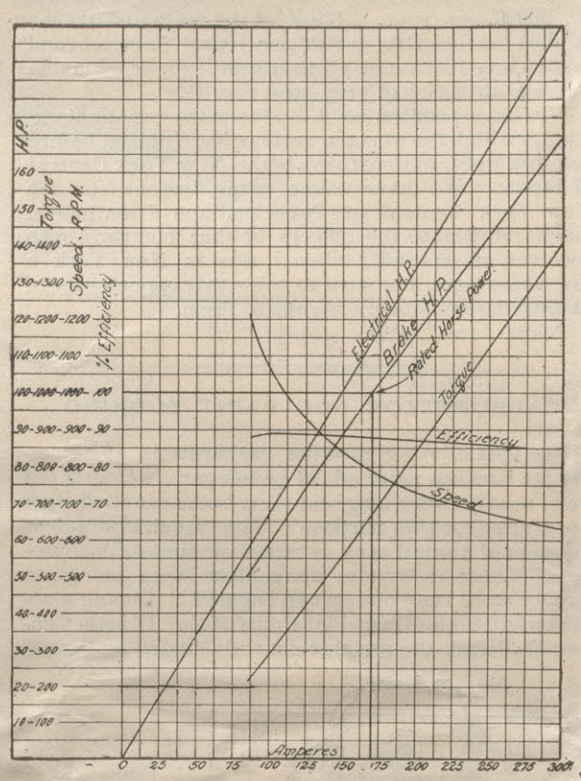


FIG. 1—COMPLETE DIAGRAM D. C. SERIES MOTOR.

motor with a given circuit pressure and load is by reducing the pressure at the motor. This is done by putting into the circuit a rheostat or diverter. It is a simple coil of iron or steel ribbon or wire so arranged that heating will not destroy it. The coils are generally packed in asbestos or its equivalent. The effect of the resistance is to offer an obstruction to the current or to choke it, so that part of the line pressure is used up in pushing the current through the resistance. There is a considerable loss in the resistance, as it becomes very hot and energy is wasted in the form of heat. Motors are not so economical when runwith a resistance in circuit. The loss varies as the square of the current flowing and directly as the resistance. That is, if the current is doubled and the resistance unchanged the loss is four times as great, but if the resistance is doubled and the current unchanged the loss is only doubled.

Fig. 2 shows the relation between the speed and load of the motor considered in Fig. 1, when the line pressure is constant. The normal speed of the motor is 780 revolutions per minute when the power developed at the armature shaft is 100 horse power. When the horse power is increased to 170 the speed drops to 630. When the horse power drops to 52, the motor increases in speed to 1,200 revolutions. It is seen from this curve that a very small drop in speed below the normal speed at the rated horse power gives a very great increase in power. Thus a drop from 780 to 630 revolutions per minute—or 150 revolutions—gives an increase of 70 horse power, while an increase of speed from 780 to 1,200—or 420 revolutions—requires only a decrease of 48 horse power. It is not economical to use a resistance in the circuit of a direct current motor to decrease the speed, and therefore in most cases motors are run without resistance except when starting a load and under other special or abnormal conditions. It is necessary, therefore, in selecting the gearing to study the speed and power curves of the motor, together with the requirements of the service in which the motor is used. It is useful for this reason to study the limit of speed and load under which a motor can be run without a resistance in circuit. Take the motor whose characteristic curve is given in Fig. 2; it can be run continuously at 100 horse power (780 revolutions) on 500 volts pressure. If the horse power is greater the motor will get too hot and the length of the continuous run, without stopping to allow the motor to cool off, must be reduced. Many direct current motors will not run for more than one hour at the rated horse power without overheating. If motors are exposed to a draft of cold air they can be run at a greater horse power without overheating. Motors under street cars, owing to their exposed position, can be run with a greater overload than would be possible if they were in a heated workshop.

This motor, Fig. 2 can be run without resistance on a 500 volt pressure down to 52 horse power. At this point the armature speed reaches 1,200 revolutions per minute, which is not a speed where the armature windings will be liable to injury, but it is as high as it is advisable to run for positive security. The variation of continuous running without resistance in circuit is, then, from 22 horse power to 100 horse power and from 780 to 1,200 revolutions. For greater loads the length of the run must be reduced and by making the time of overloading suitable to the overload, the horse power may be increased to 170. To do this the speed must be reduced to 630 revolutions. That is, when there is no resistance in the circuit and the line pressure is constant, all direct current motors have a particular speed for each horse power. This is clearly shown on the diagram Fig. 2. Perhaps this is the most useful of all the diagrams relating to direct current motors, as it gives the speed at which a motor must run to get any given horse power within its range.

In the same way Fig. 3 shows the relation of pull of the motor to the speed, and the foregoing remarks about the limits of speed and horse power apply with equal force to the limits of speed and pull. That is for each given speed without resistance in the circuit and with a constant line pressure and within the range of the motor, there is a particular pull it will give. Each change of pull carries with it a change of speed. The pull of electric motors is called the "torque". It is the pull in pounds which the motor can give on end of crank one foot long or on the rim of a pulley two feet in diameter. As shown by Fig. 3, the range of this motor for continuous running is from 780 revolutions and 670 pounds torque to 1200 revolutions and 210 pounds torque. For running a a limited time the torque can be increased to 1400 pounds at 630 revolutions.

The current in amperes that will be taken from the line to do the work called for on Fig. 2 or to give the pull indicated by Fig. 3 is shown by similar diagram not reproduced This diagram gives the relation of the speed of the motor to the current in amperes that will be taken into the motor from the line and shows what current must be furnished from the central station for one motor.

The effect of introducing a resistance into the circuit is practically to cut down the line pressure. This always makes a motor run slower than with full pressure. While it is impossible to run a D. C. motor at a higher horse power or pull than that given for each speed on the characteristic diagrams of the motor, yet it is possible to run with less horse power and pull by introducing the proper amount of resistance into the circuit. The diagrams not only show the limits between which the motor can be worked, but also show the particular speed for each particular horse power and pull when there is no resistance in the circuit. When the resistance is intro-

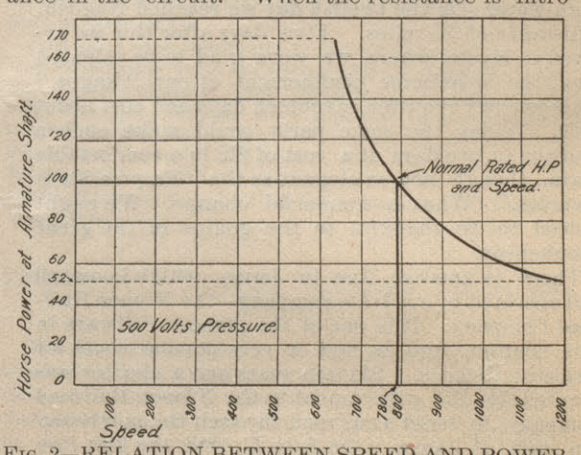


FIG. 2—RELATION BETWEEN SPEED AND POWER.

duced the diagrams do not apply and one must resort to calculation, or obtain from the builders a set of diagrams showing the characteristic curves for different line pressures. Then by calculation one can find the reduction of line pressure that will be made by a given resistance when a given current is flowing and select the proper diagram for the reduced pressure. The product of the resistance, in ohms, that is introducted into the circuit by the amperes of current flowing into the motor, will give the drop in the pressures due to the resistance introduced.

Diagrams of this kind can always be obtained from makers of motors. They are made from the tabulated results of tests and represent for motors what a full set of experimental tests would indicate about a steam locomotive if furnished to the purchaser b

locomotive builders. The great value of such tests to users of steam locomotives is now being shown to us by the admirable results from the testing plant for steam locomotives on the Chicago & Northwestern Railway in Chicago. This plant enables the mechanical officers to speak with certainty about the action of the locomotives on the road under all practical conditions. With electric motors the manufacturers have taken up the work of testing, and each motor is examined minutely and a full record made of its performance,so that purchasers may know just what will be the action of the motors under a large variety of practical conditions.

There is much gratification to be found in the fact that the electric motor which promises to invade the field now occupied by steam locomotives, is simple in construction and operation, and in the further fact that the relations of speed, power, pull and efficiency can be simply and positively expressed on a diagram readily understood by those who will have charge of the maintenance and operation. It should not reflect, however, on steam locomotive practice, that the same complete data cannot now be furnished for steam motors as is offered for electric motors, even

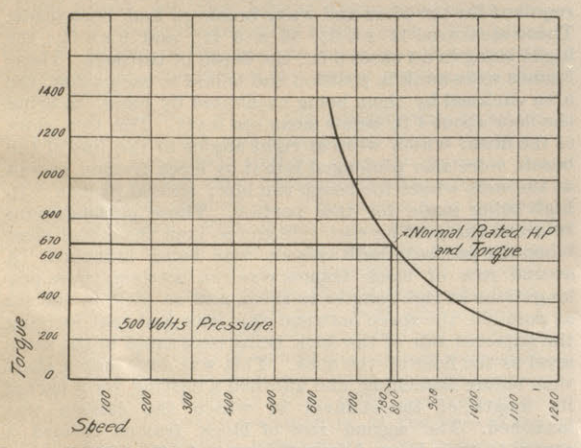


FIG. 3—RELATION BETWEEN SPEED AND PULL

although the steam motor has been in use for many years. The complexity of the steam locomotive mechanism and the great variety of factors which affect the economy make it very difficult to reach conclusions, even after a long series of tests, and for this reason we may never hope to be able to draw a diagram or a set of diagrams about any steam locomotive which will express so completely the relation between the speed, power and efficiency as is given by Fig. 1 for an electric motor. Probably we would not find it so difficult to deduce the relations of these factors for steam locomotives if we had the steam using apparatus alone to deal with in the steam locomotive, just as we have only the current using apparatus to treat of in the electric motor. The insurmountable obstacle in the way of a complete exposition of the relations between speed, power and efficiency in the steam locomotive is found in the fact that the steam motor must carry the complete steam generating apparatus. Such apparatus, distorted as it is by the limits of space and weight, cramps and hinders the steam using mechanism. The electric locomotive when complete with all the essential features for successful practical operation has less weight than is needed for tractive power and the motors need not be cramped for lack of space. This, together with the fact that the power generating apparatus is fixed at a central station, indicates that the electric locomotive is as simple, and may be made to be a more efficient, machine than the steam locomotive, at least all the formulas expressing the operation can be more easily deduced and are more exact in application.

PISTON ROD FASTENINGS.

In view of the trouble which has been experienced upon locomotives with broken piston rods, especially considering those breakages which occur at the cross-head ends and which take place frequently with certain types of cross-heads, the following quotation from Mr. F. A. Halsey in the American Machinist is pertinent.

While this subject is up for discussion, will someone please rise and explain the reason for the conventional taper fit between piston rod and cross-head hub in engines using keyed-in rods.

A good many engines have been built from my designs in which this fit was made straight, and if there is any objection to the arrangement it has not come to my knowledge.

I cannot see that the taper fit accomplishes any good purpose whatever, while it does accomplish the distinctly bad purpose of throwing a heavy and useless bursting strain on the cross-head hub. A taper fit is an expensive one to make, especially in this case, where the rod must be of a given length outside the cross-head boss—the matter being aggravated by the drawing of the rod into the hole by the draft of the key. Considerable cutting and trying is therefore necessary.

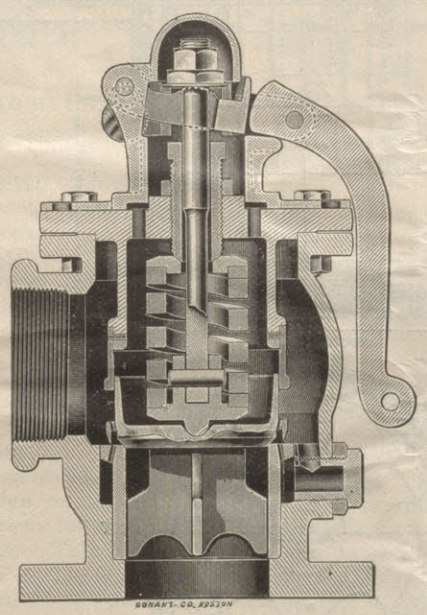
The straight rods are turned full size to the end without any shoulder whatever, and bottom on the bottom of the hole in the cross-head boss. They are made an easy sliding fit, which makes removal at any time a simple matter. The great advantage of the straight fit, however, is that it permits the rod to be boldly cut to length and finished at the first handling.

This avoidance of repeatedly putting together and taking apart is one of the sources of shop economy which is not worked as it should be. It is carried to an extent in some shops which the old-time, cut-and-dried machinest would not believe possible, and there is no more fruitful field for a designer to study than to so lay out his work as to encourage it.

In the case of the fit in the piston, there is some excuse for the taper. At that end the rod cannot be made to bottom on its end. To forge on a collar is expensive, while to turn down for a shoulder of sufficient area reduces the area of the section of the rod. This area is still further reduced by the keyway or the threads for the nut, leaving a small net section, unless the rod is of excessive diameter to begin with; but if any one can give any excuse for the taper fit, or any objection to the straight one, at the cross-head end he will afford me information which I have sought for in vain.

A NEW POP SAFETY VALVE.

The Ashton Valve Company of Boston has recently placed on the market a new safety valve for stationary boilers. This valve is known as the new No. 3, and it embodies improvements over other forms which have been used in stationary practice. The usual form of lever for pop valves is a simple straight trip, which has not been found satisfactory for the reason that it has not been sufficiently powerful to lift the valve off its seat unless the steam pressure was nearly at the popping point. Blocks and tackles have been used to operate the valves, but with them the levers often become bent. The valve under consideration makes use of a compound lever and an enlarged valve spindle with a pressure adjusting screw, as shown in the accompanying illustration.



NEW POP VALVE, STATIONARY FOR BOILERS

This lever gives sufficient power to permit of lifting the valve off its seat by hand without reference to the pressure beneath it.

The special features of the construction are a bevel seat at an angle of 45 deg., a knife edge pop chamber lip, and encased spring of Jessop's steel, an arrangement for changing the position of the lever and a means for adjusting or regulating the pop from the outside of the valve casing. The address of the manufacturers is 271 Franklin street, Boston, Mass.

LIQUID FUEL AND METHODS OF BURNING IT.*

HERBERT C. WILSON.

For some years past engineers have been experimenting with various fuels and combinations of fuels for the purpose of realising some economy upon the enormously wasteful results of firing boilers with coal or coke. Naturally, these experiments included trials of liquid fuels, and the satisfactory results obtained from even a crude and faulty application of hydro carbons for heating purposes at once pointed out this description of fuel as being one from which great advantages in both economy and power could readily be obtained. The result has been that many more or less satisfactory methods of utilizing liquid fuel for firing all kinds of boilers have been put forward within recent years. Before attempting to burn liquid fuel in a boiler furnace of any description it is necessary to study the nature of the fuel to be employed. There seems to be a general idea that liquid fuel means petroleum—that is to say, the ordinary petroleum of commerce—and one of the objects of this paper is to point out the impracticability, from an commercial point of view, of the general use of this hydrocarbon for the purpose. For some time it has been clearly recognized that a very heavy hydrocarbon is the only combination that is in all ways suitable for general use as liquid fuel. The residue of the distillation of petroleum or shale oil, known by the name of mazouth and astaktis, which is absolutely uninflammable up to the temperature of 350 deg. to 490 deg. Fah., may be taken as being the particular grade of liquid hydrocarbon most suitable for the purpose of firing boilers.

Although this oil has not yet received sufficient attention from chemists and engineers to clearly define its usual composition and value as regards calorific power, still the results of experiments show that its value in British thermal units is about 20,000, against an average 14,000, for coal. Broadly speaking, the position is this, that in this country, at the present moment, coal has the advantage of price, but as the demand for astaktis in England is at present small, the price is consequently high. The supplies of this oil are almost unlimited, and upon a larger demand being created immense quantities might be placed on the market at a price that coal could not be raised for. I have been lately informed that astaktis can now be obtained in the Baku district for little more than the cost of putting it into the tanks.

Again, with reference to the steam-raising powers of coal versus oil, it must not be forgotten that the coal-fired furnace is most wasteful, and in spite of the hundreds of appliances and patent systems for improving the result, it is very doubtful if more than one-half of the heat theoretically contained in each pound of coal is practically applied to the purpose of raising steam. This great loss of efficiency is chiefly owing to imperfect combustion and imperfect utilization of the actual heat given off. On the side of liquid fuel, we have a considerable increase in the theoretical calorific power, viz., 20,000 British thermal units against 14,000 for coal; further, it has been proved that in practice almost the whole of this available heat can be taken up and transmitted to the boiler water, when the oil is burnt in a furnace that rigidly complies with the special requirements. The net result is therefore that, in spite of its present high price in this country, oil fuel has a tremendous and solid advantage over coal for many purposes, which every day are tending to increase and become more generally appreciated by engineers.

It was not until the year 1874 that liquid fuel was practically used for the purposes of trade. It was about this time that the Volga Railway commenced to use oil for locomotives, and at the present time there are more than 72 locomotives fired with astaktis on this railway, and the system is becoming general on the Volga and the Caspian. In 1880 a launch called the "Billy Collins" was fitted with a liquid fuel apparatus, constructed by the Hydrocarbon Gas Co., and worked on the Thames for some time. The results were most satisfactory, especially the ease with which the fires were regulated, by simply opening or shutting the oil valves.

Perhaps the best known application, on a large scale, of liquid fuel, is that of the locomotives on the Great Eastern Railway. Mr. Holden, of the Stratford Works, has designed the method, by means of which he is able to burn oil and coal at the same time. This is effected in the following manner: The oil is thrown into the firebox in the form of fine spray obtained by air pressure by means of a special form of injector. This spray enters the fire-box just above the fire-bars, which are covered with a thin layer of coal or coke in an incandescent state. The results obtained are greatly in favor of oil, and the apparatus does not require any great alteration to be made in the existing fire-boxes. Mr. Holden's system has been adopted on the Argentine-Mexican Railways, and has been on trial in England on the North Eastern, Lancashire & Yorkshire, and Metropolitan District Railways.

In England there has recently been constructed a torpedo boat of about 86 tons displacement. She has a double bottom; this is divided up into eight water-tight compartments, which are used as tanks or bunkers for oil, and hold about 15 or 16 tons. As these compartments are emptied of oil they are run up with water, so that the draft and stability of the boat remain always the same. Her engines are of the ordinary triple expansion. The almost automatic working of the fuel apparatus allows of the crew being greatly reduced. For example: one man only is required to look after the fires. The boiler is of the ordinary locomotive type, with the special fittings necessary for liquid fuel burning. It is fitted with 31 oil jets, fed by means of a Worthington pump, which draws the oil from the double bottom and delivers it into a cylindrical tank, where it is put under air pressure before reaching the jets. When all the jets are working together in the furnace, it presents the appearance of a mass of flame without ashes, smoke or smell. It is possible to put out the jets separately or all at once. In one trial made she went twenty-one knots and developed 1,203 horse power. Then twenty-one jets were shut off suddenly, after which the steam did not rise sufficiently to blow off at the safety valve. The result of all trials up to the present time has been to show that there are only two ways of burning liquid fuel, viz., either by means of atomizers for large powers, or gasifiers for small powers. It necessarily follows, seeing that heavy oil is most uninflammable in bulk that the only way to burn it is to finely divide it up into the form of gas, vapor, or spray. This spraying is best produced by means of an atomizer, which is, generally speaking, an apparatus for introducing a

*Abstract of a paper read before the Institute of Marine Engineers, London.

stream of the oil into the center of a stream of air or steam, the effect of which is to break up the oil into fine spray. In this form the oil readily catches fire and burns in a perfectly regular and safe manner, so long as the supplies of oil and air or steam preserve their proper proportions. The effect of any considerable variation in either is to extinguish the flame or throw out the oil in an undivided state. The apparatus known as the atomizer has been brought to such a state of perfection that these difficulties may be considered practically as non-existent when used for the purpose of firing boilers. The great question is whether it is better to use steam or heated air as the dividing medium. There is much to be said both for and against each system, but I am rather in favor of the use of superheated steam, especially for marine work.

I now come to what may be considered as being the most important part of the liquid fuel question, and that is the proper and best means of fully utilizing the heat obtained from a jet of burning oil for the purpose of raising steam in a boiler.

It is well known that combustible gases become uninflammable when diluted by a too strong proportion of vapors or gases that are incombustible, and that in all these furnaces, such as described, especially those in the interior of which the heat is very intense—notably those with firebrick linings—a great proportion of these combustible elements escape without being completely oxidized, and this by reason of a complex phenomena of dissociation, of which the intensity decreases on the augmentation of the pressure of the medium where the combustion takes place, and the lowering of the temperature of this medium. This, therefore, condemns the arrangement of the single furnace, and above all, of fire brick linings.

The conditions to fulfil in order to obtain a complete and rational combustion are:

1. The division of the furnaces, in order to have a number of burning jets, between which the air is able to get in sufficient quantity to insure the integral combustion of the carbon and hydrogen contained in the fuel.

2. To receive the heat produced by the foregoing means of combustion on to a large metallic surface covered with water, and in permanent contact with the flame and where the combustion is effected.

This arrangement provides that the flame does not attain a too high interior temperature, and, consequently, does away with dissociation. It is also possible to keep the temperature, if desired, no higher than that necessary for ignition.

The heating system patented by a firm in Paris is the first to comply with these necessary conditions. In this system the flame produced by the combustible liquid is projected into a combustion tube surrounded by the water to be heated, and forming a series of Bunsen burners, in the interior of which the combustion is continued and completed in such a manner that there is nothing comes out but incombustible gases without color, the heating power of which is utilized by the usual means of tubes, etc.

It will be understood that the important principle of this system consists of the arrangement of combustion tubes traversed inside by flame and divided into several sections, between which the air is able to get in sufficient quantity, each one of these sections having its orifice of escape smaller than the mouth or entry of the one next to it, and placed at a distance apart, determined by the relative areas of the orifices under consideration, and of the volume and velocity of the jet used, so as to obtain between each interval a constant drawing in of the air necessary—and sufficient to maintain the combustion without smoke, during the transit of the section that follows this interval. This system is exceedingly simple, and permits of the rapid and complete combustion of enormous volumes of gas or vapors of hydro-carbons, or other vapors in the interior of long and narrow metal tubes surrounded with water; and consequently not presenting other than a relatively very cold contact a result hitherto considered by specialists as a material impossibility. The question of contact must not be lost sight of because in the large single furnaces, the combustion of gases or vapors, which is easily obtained when the surrounding plates are very hot, becomes almost impossible with the plates, comparatively speaking, cold unless the above arrangement is made use of.

It must be remembered that the combustion of gaseous jets surrounded by air takes place solely at their periphery or outside edge, and the interior is formed of a cone of unburned molecules of such a kind that the quantity of gas burned all over the surface of a nearly cylindrical flame, such as exists in the furnaces described, is the same at any one point as at any other. In these furnaces the combustion is absolutely complete; that is to say, there is no escape of carbonic oxide such as takes place in boilers fitted with a single furnace, where the loss of combustible from this fact alone, is very considerable, because the calorific power of carbonic oxide is about 4,000 British thermal units, or about one-fifth the value of the initial fuel. The loss of fuel due to smoke and soot in other furnaces is also very important.

At some evaporation trials made at the end of last year with this boiler, as especially designed for liquid fuel, the results were as follows: With coal tar oil the boiler evaporated 15.23 lbs. of water from and at 212 deg. Fahr. per pound of oil burned. This oil has only a theoretical calorific power of 16,048 B. T. U. With Astaktis, the boiler evaporated 18.82 lbs. of water from and at 212 deg. Fahr. per pound of oil burned. This oil has a theoretical calorific power of between 19,800 and 20,000 B. T. U. The theoretical maximum heating power of Astaktis may be taken as equivalent to an evaporation of 20.5 lbs of water from and at 212 deg. Fahr. The amount of oil consumed for this result on a trial of one hour exactly was 69.75 lbs. or 31 kilogrammes. This oil was atomized by steam from a small auxiliary generator at a pressure of 30 lbs. per square inch, and superheated to a temperature of about 900 deg. Fahr. or 500 deg. C. This boiler is about 55 per cent lighter than an ordinary coal fired boiler, and 35 per cent lighter than the other descriptions of liquid fuel boilers.

CAISSON, NORTH PIER HEAD, MADRAS HARBOR.*

ROBERT W. THOMPSON.

In the restoration of the Madras harbor the pier heads were originally designed to be 34 ft. wide and to be founded on a rubble base 34 ft. below the De Havilland mean sea level, the piers being 24 ft. wide and founded 22 ft. below that level. They terminated in an outward curve at the old pier heads into which they were to be bonded as far as practicable. In February, 1890, it was determined to modify this design, and to found the pier heads 18 ft. lower than the piers, or 40 ft. below the DeHavilland mean sea level, and to construct their ends of cylindrical monoliths of concrete, of a diameter equal to the width of the pier heads at the footings, founded at the same level and rising to a hight of 6 ft. above the level of the piers, that of the concrete capping which it was intended to place upon them. It was further determined that the monoliths should be made in the dry, instead of discharging concrete into the sea.

For each pier head a water tight iron caisson, Fig. 1, was therefore provided, of 42 ft. and 41 ft. 5½ in. outside diameter at the base and top respectively, and 53 ft. high. The bottom and sides were covered by plating ¼ in. thick. The sides were constructed in 14 tiers or bands consisting each of 8 plates 16 ft. 6 in. long by 4 ft. high. Both the bottom and sides were strengthened with ribs of lattice girders. Across the bottom, each one along the center of a row of plates, 10 girders, 2 ft. high, were placed 3 ft. 9

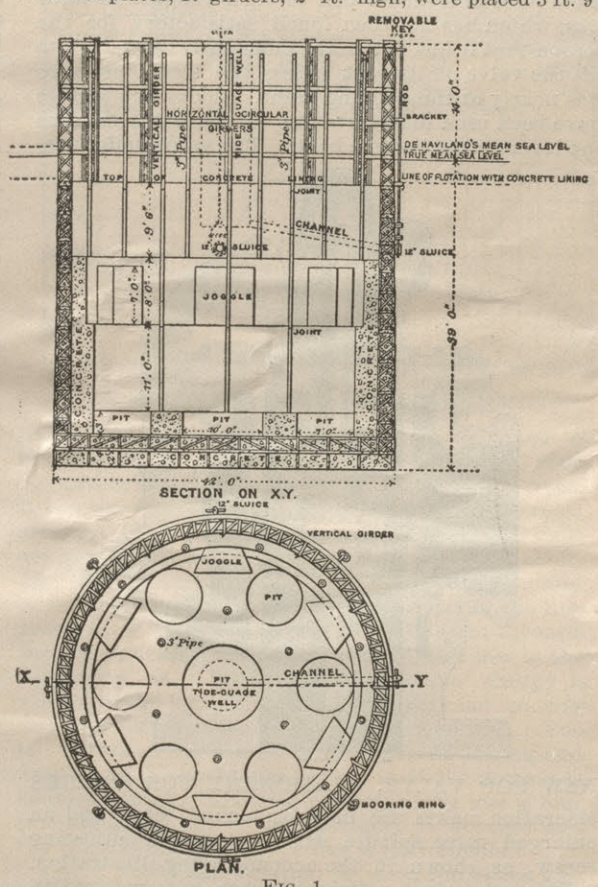


FIG. 1.

3-16 in. apart from center to center. The sides were supported by 15 circular girders, varying in depth between 1 ft. 9 in. at the bottom and 1 ft. 6 in. at the top, placed horizontally; and 12 vertical girders varying in depth between 2 ft. at the bottom and 1 ft. 9 in. at the top. The vertical girders were set at equal distances apart; they are continuous only in the flange nearest the center of the caisson, which consists of an angle iron 3x3x⅜ in. in two lengths, connected by a bar cover riveted to them, the joint being 23 ft. 10 in. from the bottom of the caisson. The other portions are in sections suiting the distances between the horizontal girders and are let in between them and riveted to the side plating by ¾ in. rivets of 5 in. pitch, the tiers of side plates being riveted together by ⅝ in. rivets of 2½ in. pitch. The plating is laid telescopically, so that each tier is ½ in. smaller in diameter than the one immediately below it.

The caisson was furnished with eight mooring rings in two tiers 19 ft. 10 in. and 43 ft. 8 in. respectively, from the bottom. It was also furnished with four 12 in. sluice valves fitted to the outside of the eighth tier of side plates, 27 ft. 7 in. from the bottom. Eighteen 3 in. wrought iron pipes riveted over 3 in. holes in the bottom were also provided, twelve being placed at the angles of a regular polygon of twelve sides 34 ft. 6 in. in diameter, and six at the angles of a hexagon 18 ft. in diameter, the centers of both polygons coinciding with that of the caisson. The pipes are for the purpose of grouting the rubble base beneath the caisson with liquid cement. They had screw ends and were built to a hight of 50 ft. in three lengths. Their hight could not be reduced as the base could not be grouted till the caisson had been filled with concrete, or nearly so. They had also to be built while the caisson was afloat. Great difficulty was experienced in getting to the tops of these slender pipes to add new lengths, and in securing them as they were built; for they were too slender to support themselves as the caisson rolled and pitched. Bracing had therefore to be inserted between them and the sides of the caisson which hindered the lowering of materials and plant. Great anxiety was felt lest a fracture should occur below the water line, the consequence of which would, in all probability, have been the sinking of the caisson.

The caisson for the north pier head was built by Messrs. P. & W. Maclellan, Limited, Clutha Works, Glasgow, and that for the south pier head by the Teeside Iron & Engine Works Co., Limited, Middlesbrough. They are similar, except that the former has an additional bracing of three transverse bottom lattice girders 2 ft. deep, riveted over the tops of the other ten and at right angles to them. They are placed one at the center and the other two 11 ft. from it on each side.

The north caisson was received in its component sections, and was built in a small temporary dock, about 50 ft. square, constructed at a shelving part of the sandy beach inside Madras Harbor. The sides of this dock were composed of old block frames or molds in which the blocks required for the piers and wave breakers had been made. These measured 14 x 6 ft., 10 x 6 ft., and 9 x 6 ft.; the hight being in all cases 6 ft., the depth of the dock. These frames were sunk in position and bolted to each other, the area enclosed by them being excavated by hand, to bring the floor about 4 ft. below mean sea level. The two sides of the dock, which were at right angles to the line of the beach, were also prolonged into it by block frames, except at the ends where the beach ran low; special frames 8 ft. high being made for this portion. These prolongations retained the sand on each side, and so kept the outlet clear when the partially built caisson was being launched. A second row of block frames was run between these prolongations at right angles to them, and as close to the sea as possible, the space between this row and that forming the adjacent side of the dock being excavated to the same level as the floor of the dock. This was done only a short time before launching, and afforded a cutting, for a part of its length, of the channel in which the caisson was launched. The second row of block frames formed a screen to exclude sand from the sea. As the block frames were set in position they were filled with stones and sand. A small sump was sunk at one corner of the dock into which the suction pipe of a No. 7 pulsometer was introduced, the dock being thus kept sufficiently dry. A railway siding of 5 ft. 6 in. gage was laid from an adjacent line to the dock to provide communication with the workshop yard, and a powerful hand crane on wheels was placed at the end of this siding to transfer the material from the trucks to the dock.

Inside the dock a temporary staging about 8½ feet high was constructed of sleepers and rails, and so arranged that the seams of the bottom of the caisson which were to be riveted, were left accessible to the riveters. The caisson was built to a hight of two tiers of the side plating, about 7 ft. 9 in., on this staging. It was then lowered and rested on the bed of the dock. This was accomplished by admitting water into the dock through a pipe till the caisson, which at that stage drew only about 6 in. of water, floated off the staging. The rails and sleepers were then drawn from under it and the water was pumped out of the dock when the caisson rested on the floor. Water was subsequently let into the caisson and pumping of the dock was discontinued, as the riveting had reached above the level to which the water could rise within it. The riveters on the outside worked on hook trays, 6½ ft. long by 3 ft. wide, which were hung on the side plating; while those inside were accommodated on planks resting on the circular girders. The caisson was thus built to a hight of six plates, or 23 ft., when it weighed about 50 tons, and drew about 15 in. of water. The barriers of block frames, which lay between it and the sea were then removed and the sand beyond the outside barrier excavated. A steam launch then took the caisson in tow, while a force of coolies pushed it from behind, and it was successfully launched. The caisson was towed to the elbow bend of the north pier and moored within a few feet of it, and the work of charging with concrete was at once commenced. A solid floor of concrete 4 ft. thick was first deposited, causing the caisson to draw 10 ft. of water, and a thickness of 3 ft. was then added, seven circular pits, Fig. 1, being left. The caisson was thus lowered an additional 5 ft., drawing 15 ft. of water, and standing 8 ft. out of the water. The building up of the sides was then proceeded with, as well as the insertion and fixing of the wooden framing for lining the sides with concrete.

The circular pits in the concrete floor were made by wooden core frames; that for the 10 ft. pit being in six, and those for the 7 ft. pits being in four pieces. The concrete lining was also built by means of wooden frames, that for the lower portion 5 ft. thick, being in ten pieces. These frames were only 5 ft. 6 in. in hight, and were used twice in the 11 ft. of hight of this portion of the lining; being lifted on to wooden putlogs or brackets built and anchored into the lower half when the upper half had to be built. In the framing required for building the second portion, 4 ft. thick, provision had to be made for six dovetailed joggles, Fig. 2. These are 3 ft. thick and overhang the lower portion of the concrete lining by 2 ft. The parts A and B were distinct and were placed 5 ft. apart; the back planking C was then set in position between them, and boards for the floor placed with one end resting on a waling piece at the bottom of the

*A paper read before the Institution of Civil Engineers.

back planking and the other on the lower portion of the lining. The frames were held upright by iron rods with a screw and nut at one end and a hook at the other; the screw end being passed through the upper member of the back frame and the hook fastening on one of the circular girders. The upper portion of the lining was built by fixing to the rib girders the iron sheets intended for the upper band of plating of the caisson.

When about 3 ft. of the first portion of the lining had been inserted it became necessary to move the caisson from the berth near the pier to one further out in the harbor clear of the rubble base on which the pier is built over which there was not sufficient depth of water. The concrete required for the lining was therefore taken out from the pier in boats and handed up in baskets to men standing on swing trays hanging from the plating who shot it down through canvas shoots wherever required; men being stationed below to receive it and work it down. The riveting was completed on the 3rd of March, and the concrete lining in five days from that date; the caisson then drew 36 ft. of water. It was originally intended to make the concrete lining so that the caisson would draw 37 ft. of water allowing 3 ft. between the bottom and the rubble base upon which it was to be set. It was assumed that high water at the time would rise to at least the De Havilland mean sea level, or 40 ft. above the rubble base. But the tide tables for the year showed that high water about the time would not rise higher than true mean sea level, or 39 ft. above the prepared rubble base. The hight of the 4 ft. portion of the concrete lining was therefore diminished by 1 ft., and that of the upper portion was also slightly reduced.

The rubble base upon which the caisson was to be set was carefully examined and was made with a slight inclination to tilt the caisson slightly inwards towards the the blockwork of the pier head and the wave breakers, which would lean against it. The approach to the spot was also examined. The caisson had previously been brought up and berthed close to the pier head, not far from its final position. Hawsers were then attached, one leading to the north pier head, one to the old north pier head, one to the south pier head, one to a boat anchored in a suitable position a little outside of the harbor and one to the steam launch. A system of signals having been arranged, the caisson was released from her berth and the hauling began. It was a calm morning and no hitch occurred. Four men had been stationed on swing-trays at the keys of the four 12 in. sluices already mentioned. The instant the caisson was in position these were opened and the caisson almost immediately grounded. About 500 tons of water were then admitted. This weight left about 400 tons to keep the caisson in position, but as an additional precaution, a stout hawser was passed round it and the two ends made fast to the pier head.

One cylindrical concrete block 8 ft. in diameter and 8 ft. high, weighing 25 tons, four cylindrical blocks 5 ft. in diameter and 8 ft. high, weighing 40 tons; five ordinary wave breaker blocks 9 x 9 x 6 ft., weighing 150 tons; and nine special blocks, each 9 x 4½ x 6 ft., weighing 135 tons, were then lowered through the water into the caisson. The large cylindrical block was placed in the center pit, and the four small blocks in the four side pits nearest the pier head; the other two pits being beyond the reach of the crane, the remaining blocks were placed upon these and each other. The water was subsequently pumped out by the pulsometer, and the concreting was was proceeded with. When the work had reached to about 5 ft. above the floor level three of the wave breaker blocks were taken

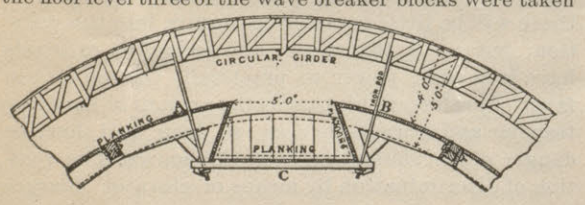


FIG. 2.

out and some of the small blocks were rearranged so as to surround them with concrete. Other small blocks, 9x4½x6 ft., were inserted as the concreting proceeded and were buried in it.

The four 12 in. sluices admitted a large volume of water into the caisson in a short time, in order to sink it quickly as soon as it arrived in position. After the concrete had been filled in, these sluices were detached. The filling was not carried up solid to the top. A well, 6 ft. in diameter and 23 ft. deep, was left in the center for a tide gage, and a channel 1 ft. square in section, was arranged between the bottom of this well and the sluice hole opening into the harbor. It is intended to erect a small lighthouse, 21 ft. high, upon this cylinder of concrete, to light entrance to the harbor. The lighthouse is to be divided by a floor into two chambers, the lower being a tide gage room and the upper a lamp service room.

The time occupied by the work was six months: the riveting together of the caisson having commenced in October, 1893, and the filling of it with concrete at the pier-head being completed on the 31st of March, 1894.

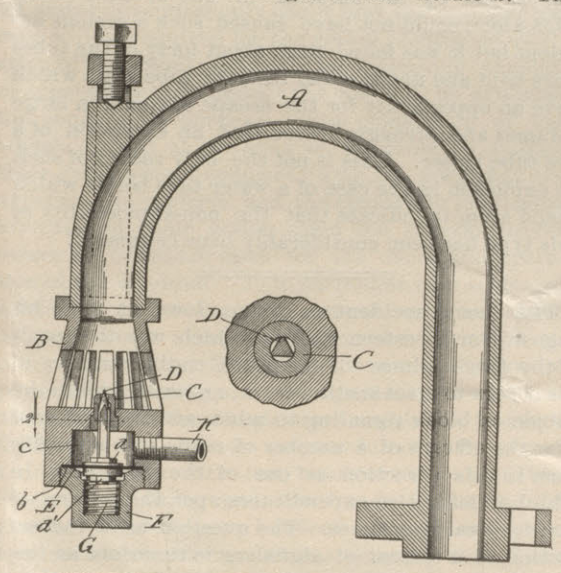
The last or upper band of iron plating was not put on, and the concreting is therefore short of the ultimate intended hight by 4 ft. The surface as left at present is not level throughout, but has been stepped to receive the remaining concrete to be added later.

The London Statist says that electric traction is making considerable progress in England. Experiments with electric power are being conducted by the two London underground roads and the new Central London Railway will also be equipped. Its adoption on a general scale is thought quite likely.

DEAN'S PNEUMATIC TRACK SANDER.

An improvement upon the pneumatic track sander designed by Mr. F. M. Dean, of Huron, South Dakota, an employe of the Chicago & Northwestern Railway, has just been completed and patented, and the device has been applied to several locomotives of that road. The primary object of the improvement is to prevent any liability of the blast nozzle and passages becoming filled and clogged with sand. The jolting and jarring of the locomotive sometimes causes difficulty by the packing of the sand so tightly as to prevent its running freely. The illustration shows a vertical section through the siphon and attached cage which is placed in the sand box and bolted over the opening to the sand delivery pipe. The small drawing is a horizontal section on line 2 of the section of the siphon.

The siphon-shaped pipe A connects at one end with a sand discharge pipe and at the other with the cage B, within which is arranged a blast nozzle C. This



DEAN'S PNEUMATIC TRACK SANDER.

nozzle communicates with an interior chamber *c*, into which enters an air pressure supply pipe K, connected to the main air reservoir.

In order to normally close the orifice and passage in the nozzle to prevent the entrance of sand into the chamber and supply pipes which would eventually clog and obstruct the passage of air, a spring pressed needle or stem D, is used which carries at its lower end a diaphragm E, of elastic and flexible material. This diaphragm mounted on the needle or valve stem. As shown in the drawing it is arranged between two washers and held against a set nut *d* by screwing up a nut *d'* upon the end of the valve stem.

The edge of the diaphragm is held against an annular flange or shoulder *b* by means of a plug F, which screws into the hollow bottom or base portion of the cage. This plug is provided with a pocket to receive a spring G, which bears, respectively, upon the bottom of the pocket and against the washer on the diaphragm whereby the needle is forced upward and its end seated in the nozzle passage which it closes. The top surface of the plug is beveled inward from the edges in order to accommodate the movement of the diaphragm. The spring is of the proper tension in order that the diaphragm and needle may be operated by the pressure.

As illustrated in the sectional view, the needle is triangular in cross-section except at the end or point, so as to allow the pressure to pass freely past it through the passage in the nozzle.

The parts being in the normal position air pressure is admitted by the engineer through the ¾ in. supply pipe K into chamber *c* whereupon the diaphragm is forced downward against the tension of the spring. The needle or stem is consequently withdrawn and a free passage made through the nozzle. The sand is sucked into the cages and ejected through the discharge pipes. When the pressure supply is cut off, the spring restores the diaphragm to normal position and closes the orifice. It will be noticed that in constructing the siphon the upper wall is made thicker than the lower one at the top of the bend, which is to guard against wearing the pipe through by the cutting action of the sand. The cleaning needle is made of ¼ in. round iron flattened on three sides, as shown. If the motion of the locomotive should cause the sand to become packed in the air nozzle and to rest on the point of the cleaning needle it will be loosened by the removal of the needle upon the application of the air pressure.

A large driving belt has just been completed by the Chicago Belting Company, of Chicago, for the engine-room of the Louisiana Electric Light Company, of New Orleans. It is 150 feet in length, 7 feet wide, ⅝-inch thick, and weighs 3,300 pounds. Selected portions of 450 oak-tanned hides, specially chosen from some 5,000 skins, were employed in its construction. There is not a stitch or rivet in it from one end to the other, the hides being pasted together with boiling glue and then subjected to a hydraulic pressure of about 220 tons. The belt is to run from a 28-foot driving wheel, and will be capable of transmitting about 3,000 horse power.—[Practical Engineer.]

LOCOMOTIVES FOR CAPE GOVERNMENT RAILWAYS.

The Cape government railways have recently received a number of locomotives from Messrs. Dubs & Company of Glasgow which were constructed from designs by Mr. M. Stephens the late chief locomotive engineer of these railways. They are described by the Railway Engineer as follows: "The most notable novel features about them are the piston rod guide at the front end of the cylinders and the drop finger fire bars. The object of the latter is to enable the Colonial coal from Viljoen's Drift to be used. The extension of a piston rod to form a guide has been found to answer admirably and to study the engine very much when running. Mr. H. M. Beatty, who has succeeded Mr. Stephens and to whom we are indebted for the data, informs us that these engines have given every satisfaction in service. The following are the leading dimensions:"

Cylinders	17 ft by 26 in
Gage	3 ft. 6 in
Coupled wheels (diameter)	4 ft. 6 in
Tires	3 in. thick by 5⅛ in
Truck wheels	2 ft. 4⅛ in
Center of truck to center of leading coupled axle	6 ft 7 in.
Center of truck to center driving axle	4 ft. 9 in
Center of truck to trailing axle	6 ft. 3 in
Wheel base	17 ft. 7 in
Boiler barrel (diameter inside)	4 ft. 5½ in
Boiler barrel (length)	11 ft. 2⅛ in
185 tubes	1⅝ outside diam
Inside fire-box	2 ft. 3¼ in. by 7 ft. 2⅛ in
Outside fire-box	2 ft. 11¾ in. by 8 ft. 0 in.
Boiler pressure	160 lbs. per sq. in
Heating surface—	
Tubes	1,014 sq. ft
Fire-box	101 sq. ft
Total	1,115 sq. ft.
Grate area	16.6 sq. ft
Weights—	
On the truck	22,010 lbs
On the first axle	23,700 lbs
On the driving axle	27,230 lbs
On the trailing axle	26,890 lbs
Total	99,830

Prices of M. C. B. Couplers and Parts

We are requested by the secretary of the Master Car Builders' Association to publish the subjoined letter in the hope that those manufacturerers of M. C. B. couplers whose addresses are unknown to him, may furnish to him the desired information.

THE MASTER CAR BUILDERS' ASSOCIATION,
Office of Secretary, No. 974 Rookery,
CHICAGO, August 3, 1896.

To M. C. B. Coupler Manufacturers:

Section 13 of Rule 5 of the revised code of rules of interchange. which goes into effect on September 1, 1896, provides that

"M. C. B. couplers. or parts of same, to be charged at manufacturers' current market prices, or replacement prices, which are to be quoted by the secretary, September 1 and and March 1 of each year. When the coupler manufacturers do not quote a replacement price, and do not require the return of the scrap for the price quoted, the credits for scrap shall be allowed at the rates given in the above list."

Under these revised rules of interchange, all car owners are chargeable with the repairs to their cars when away from home, necessitated by ordinary wear and tear from fair service.

Will you kindly quote, sometime prior to August 20, the figures which I should publish to the members as the current market prices or replacement prices, for your coupler and the parts thereof, and oblige,

Yours truly,

J. W. CLOUD, Secretary.

Drainage Canal Excursion.

The Entertainment Committee of the Western Society of Engineers has arranged an excursion down the Drainage Canal to take place Saturday, August 15th, 1896,. A special train has been tendered by the officials of the Santa Fe route and will leave the Polk Street Station at 8.30 a. m., returning so as to reach the city at 5.30 p. m.

A 36-page pamphlet handsomely illustrated, descriptive of the work has been prepared by the committee as a guide for the trip, and will be distributed on the train as a complimentary souvenir.

As this will probably be the last excursion of the society to the Drainage Canal before the completion of the work, arrangments have been made for an unusually large attendance of members and their friends.

The committee has gone to considerable pains and expense to make the lunch an attractive feature.

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CHICAGO, SATURDAY, AUGUST 8, 1896.

THE depression in trade and manufacturing becomes more pronounced and commercial failures of some magnitude emphasizes the fact that the country is still drifting in sight of rocks. The increase in gold reserve, the cessation of gold exports and the emphatic utterances of the country's brightest and ablest business men and politicians do not bring about those results which were promised. Trade languishes, production is not stimulated, building operations have been halted, railroad work increases slowly, new enterprises hug their pigeon holes and drawing boards. The iron trade drags. Steel makers met and refused to reduce quotations. Pig iron production has begun to decline. Lower prices have been named for several products. Nothing of a panicky nature has shown itself but the elements are not wanting. The financial issue is evidently causing trouble and even the remote possibility of a disorganization of the standard of measurement appears to be a sufficient warrant to defer well matured plans for broadening industrial activity.

A VERY natural question to ask at this time of a master mechanic is what his impressions were of the Saratoga conventions, and upon making some observations with reference to the meetings during a call upon one of these officers recently a rather surprising answer was returned to the effect that the annual conventions were of very little value and that for years they had not repaid the trouble and expense necessary to attend them. Considering this an unreasoning and unreasonable criticism, the subject was pursued to the development of the fact that this man's objection to the association was founded upon the inconsistencies with regard to the observance of the standards established from time to time at the conventions. Attention was called to this matter by one of the speakers at the last convention of the Master Car-Builder's Association. This member spoke pointedly of the practice of many of the members of voting to establish standards and standard practices and immediately upon returning home proceeding to put designs into effect without reference to those standards. This is hardly a satisfactory reason for tabooing such organizations as the ones referred to, yet the practices mentioned call for reform upon the part of some of the members. The number is probably growing less, but the trouble is not yet cured. With all of the good work accomplished by the associations there is none more important than the systematizing and standardizing of the practices of different roads, and this function should never be lost sight of, but rather it should be followed up with more care than ever in the hope of securing still greater benefits from it with the approaching general introduction of steel in car construction.

AN accident recently occurred to the boilers of the French war ship "Juareguiberry" which seems likely to shake the confidence which many have placed in water tube boilers under the impression that this type of construction will absolutely prevent explosions. It is undoubtedly true that this type renders the chances for disastrous explosions very much less than with the fire tube forms. The accident referred to was probably the result of low water and it indicates that the water tube boilers, as well as others, will bear watching as to the water line, for with hot tubes or sheets a rupture of considerable size is quite likely to occur. This accident occurred just after the fires had been cleaned after a run of twenty hours upon a twenty-four hour trial trip, and while the vessel was making seventeen knots. An explosion was heard in the end boiler which was followed by the bursting open of several of the furnace fronts which caused the death of six firemen. These boilers were known as the Lagrafel d'Allest type which consists of a large firebox of the locomotive pattern provided with inclined water tubes crossing the furnace from one side to the other above the grates, and which connect the water spaces of the boiler for circulation. The accident was caused by the bursting of one of these tubes. This alone could not have caused such a serious accident but it was found that about forty of the tubes were bent and drawn away from the tube plate which gave an opportunity for the escape of steam in large volumes and strongly resembled an explosion of a fire tube boiler. This is not the only record of such an explosion in the case of a water tube boiler which would seem to indicate that the non-explosibility of this type has been considerably over estimated.

THE recent accident at Logan, Iowa on the Chicago & Northwestern Railway which was the result of the forgetfulness of one of the engine runners of his orders to meet another train, naturally brings the subject of block signaling to mind, and it is believed that the officers of a number of roads will naturally turn in this direction as one of the first lines in which to authorize expenditures upon the return of dividend earning times. The question as to the selection of a system of signaling is therefore an important one, and it is well enough that some time should be occupied in a comparison of the systems, lest expensive mistakes should be made in the selection. There are two types or systems which give satisfactory protection, and the cost of installation and operation differs so widely as to amount to what is practically a prohibition in certain forms of one of them. This high cost operates against the adoption of any block system because of the feeling, which is quite general, that the most expensive type, the controlled manual, is the only safe form to use. If it were generally believed that the necessities of train spacing could as well be met by the cheaper automatic systems, it is believed that more of this apparatus would be used at the present time, and also that this type would be selected for general use in this country when the time arrives for a selection between the systems.

In this connection the following quotation from one of the best known signal engineers in the country, writing in a contemporary journal, is appropriate.

The choice is not usually to be made between the two systems, but for most railroads between one which costs less and can perhaps be afforded—at least for the most dangerous points—and one which costs so much as to be practically out of the question for all American roads except the largest and most prosperous; between a system fulfiling the most essential requirements of an absolute block system, with some advantages peculiar to itself, and none at all; between one which can be maintained in a state of very high efficiency, with some defects (the extent and importance of which are now pretty well understood and can be almost absolutely guarded against), and *nothing*—between a very perfect protection at a moderate cost, and no protection at all. It is my belief that more safety can be secured and a greater facility for operation by spending a certain limited sum of money for automatic signals than for manual ones, provided always that onl the best systems be chosen and that they be installed and operated with the safeguards that experience has shown to be necessary. Were the question approached from this point of view, the use of automatic signals would be much more general than it is, with a corresponding gain in safety and economy of operation. It would not then be the rule, as it now too often is, to equip perhaps a few junctions or terminals with signaling apparatus, and leave entire divisions carrying a heavy traffic wholly unprotected; it would not happen, as it has many times in recent years, that passenger trains are run following each other at a high rate of speed in a fog under two or three minutes' headway, with no safeguards at all, except the uncertain and delusive flag carried back by a rear brakeman, who may go a few yards or half a mile, or if he does his whole duty, may be too late to save a collision. One accident, such as we can all recall, prevented in a generation, will equip and maintain a whole division with automatic signals; a single life saved would, on a money basis. pay for ten such signals; one injury prevented might maintain them forever.

RATE INVESTIGATIONS.

The demoralization in rates on grain from Kansas City to Chicago, was referred to at some length in our issue of last week. The condition of affairs in connection with this traffic is now likely to have a full expose. The Interstate Commerce Commission has of its own motion instituted an investigation and it is likely that the result will be such a treatment of the proportional rate question as will serve not only to straighten out the tangles in the Missouri river rates but definitely determine the illegality of the entire practice. Milling in transit, forwarding on balance of through rate and differing rates according to origin or destination, are all phases of an abuse which cannot too soon be eliminated from railroad practice. It is as easy to maintain a parity between gold and silver under widely varying conditions of production and consumption, as to attempt to preserve an equality of rates and avoid discrimination where any of these practices exist. Government fiat will be found no stronger in one case than in the other.

The investigation which is being made promises to reveal some other matters not directly connected with the primary cause of the rate disturbance. Among other things, it is likely that the long standing arbitrary differentials as between Chicago and St. Louis will be shown to be such a disturbing influence as to compel the readjustment upon a more equitable basis. To attempt to prescribe proportional rates without at the same time providing for proportionate differentials would under our present system of railroad transportation be a commercial impossibility, and therefore an absurdity. If the percentage system of rates to the seaboard is to apply from Chicago, Peoria, St. Louis and other Mississippi river points, then the arbitrary differential between the Missouri river and these same points must be abolished.

So too with the elevator question in this same connection. The relation between the ownership and operation of these grain handling plants must be better defined. When the time comes, as it will come, when railroad companies shall furnish these facilities to bulk grain shippers free of charge at both the receiving and delivering stations, there will be little occasion to inquire into this question; but until that time, and so long as railroads have it in their power to practically cut the rate in favor of preferred shippers by the amount of handling transfer and storage charges, so long will there be danger of discrimination from this source. The question of discrimination by means of elevator charges is no new one. It was contemporaneous with the movement of bulk grain by rail and has continued with more or less of virulence ever since. The foundation, and in some cases the entire superstructure, of many a fortune can be found in this practice, and as already intimated, is likely to continue until put upon the same plane as other handling facilities.

In connection with the current investigation herein referred to, a gratifying change is noticeable in the attitude of witnesses. The decision of the United States supreme court in the Brown case has evidently borne fruit, and there is a willingness to furnish both oral and documentary evidence in marked contrast to previous investigations. This condition of affairs must afford an immense relief to railroad men who are desirous of shielding their companies and yet do not like to be placed in a false position. It is by no means a pleasant experience to go upon the witness stand and refuse to testify under the plea of avoiding incriminating evidence, with the knowledge that under no circumstances could any evidence given be in the least degree personally incriminating. The readiness with which evidence is now furnished is abundant indication of the relief that is afforded in this respect. It is true that little information is volunteered but that is only natural; nor will it seriously hamper the commission in its investigations. The gentlemen composing the commis-

sion are becoming tolerably well acquainted with railroad methods and will not long be baffled in any attempt to gain the desired information if only answers are forthcoming.

One other feature of the case brought out in the present examination is worthy of notice, viz: the growing disposition of managers to assist the commission in its investigation; or perhaps more properlyspeaking, to aid it in its enforcement of the law. This spirit which apparently had its conception but a few months since, has rapidly spread until not only the more conservative of these men but some who have been heretofore esteemed radical in their views, now appear ready to co-operate with the commission in abolishing violations of the law. It is also beginning to be understood by these men that the best interests of the properties they represent are conservable in the highest degree by the freest and fullest co-operation with the interstate commerce commission. The original theory of natural antagonism between the two is rapidly being disproved,and in its stead is coming to be the conviction that the one is the necessary complement of the other.

AIR COMPRESSORS.

The remarkable advances which have been made in several different lines of engineering during recent years have had to some extent the effect of spoiling people for appreciating the necessity of caution and conservatism of statement and claim with regard to the new factors which are becoming important in industrial life. Expectation is often raised to such a point as to positively preclude the possibility of achievement and the result is that improvement is finally checked below a point which might have been attained if extravagant expectations had not been raised. This has occurred with regard to electricity as a motive power, the primary battery operating upon a satisfactory financial scale not being forthcoming to meet the demand; so also the compound locomotive instead of revolutionizing the motive power of railways is not to-day given its proper place as an economy server because of the unreasonable promises made for it by its earlier promoters. The same fate awaits power transmission by compressed air if careless and unreasonable claims are allowed to prevail. The steam engine of to-day is by far the most useful prime mover, and it has not been hurried into its present advanced state but by a series of transitionary stages, it has been improved until it has reached a high efficiency. Compressed air is a good thing, in fact it is one of the greatest economy working factors in modern shop practice, but it is not a creator of perpetual motion nor can it be produced for nothing.

The time has come when it is necessary to bring these facts prominently into notice. There are many air compressors now working which should never have left the scrap heaps out of which they grew. It is difficult to see where there is economy in an air compressor run by a belt, without the aid of an adequate fly wheel or counterbalance weight, composed of parts of a number of machines and scrap pieces from old iron pipe to a pile driver crab, operating always unsatisfactorily and often requiring attention, over a high grade air compressor designed with special reference to the business which it is intended to perform. Such a makeshift apparatus, however, is not the only means by which the failure to get something for nothing may become a source of disappointment. The man who is able to secure twenty-five hundred horse power in the form of compressed air by the expenditure of one hundred and forty horse power in the form of steam engines may be said to be sure of success. It is such a claim as this that provokes these paragraphs. A usually careful and conservative contemporary gives under the caption "An Air Compressor of Exceedingly Novel Design," a description of a remarkable production in the form of engineering construction, and it also states that a company has been formed to avail itself of the profits which may accrue from the operation of the machine which is now nearly completed. This compressor is in the form of a horizontal wheel with its ten spokes and periphery composed of latticed steel girders. This horizontal wheel carries the boxes for thirty rollers or vertical wheels nine feet in diameter and weighing four and one-half tons each. These wheels are mounted three abreast in ten sets. The center wheel of each set bears upon a circular rail mounted upon the top of a plate girder which is also circular, having a diameter of eighty-two feet. At intervals along the girder one hundred compound air compressors are secured in pairs. Each pair is mounted vertically against the girder, fifty pairs being upon the inside and fifty upon the outside of the ring. These compressors are operated by levers pivoted against the girder and placed at such angles as to move the pistons of the cylinders as the wheels pass over them. The table and wheels are to be rotated by two seventy horse power vertical compound engines and the weight of the wheels and latticed frame are looked to for the wonderful multiplication of power. The wheel is to make ten revolutions per minute.

The account says: "It is calculated that of the total power developed only about four and one-half per cent will be required for the actual turning or operation of the wheel, and that the remaining amount, or ninety-five and one-half per cent will be available for commercial purposes. The momentum of the wheels carried at the ends of the arms or spokes, their great weight compared with the work they are expected to perform and the constantly increasing leverage of their action upon the several rocker levers are depended upon for the successful operation of the machine." This particular case seems too absurd to be worthy of argument, and space would not be given it except for the involved principle already referred to. Dropping the multiplication of power and glancing at the design itself, we see a machine in which the wheels alone weigh one hundred thirty-five tons. There are one hundred compound air compressors with one hundred piston rods, two hundred cylinders, and two hundred pistons and glands. There are one hundred rocking levers, two hundred short link connections between the piston rods and the rocking levers and five hundred pin bearings, all this and a horizontal structural steel wheel eighty two feet in diameter and producing twenty-five hundred horse power for the two seventy horse power engines to operate. Further criticism of the design does not seem necessary in order to draw attention to the desirability of placing the responsibility of getting up new air compressors in the hands of men who have made this branch of engineering a subject of study and experiment. Such men are to be found, and the less work of this character that is done by inexperienced persons and the less extravagant claims that are made for pneumatic power the better for the success of that form of transmission of energy.

SHOP NOTES—ILLINOIS CENTRAL RAILROAD.

II.—Burnside, Locomotive Department.

Last week some notes were presented in connection with a visit to the car department of these works, but lack of space prevented speaking of the locomotive department at that time. This department was found busy upon repair work and with an equipment of about a thousand men a locomotive is being turned out in every working day, in addition to carrying on all of the machine and smith work for the car department. The main building of the locomotive shop is 552 ft. long by 160 ft. wide and is divided into two parts, one side being devoted to erecting work which is done over pits, of which there are 24, and the other portion of the shop is devoted to the machine and repair work. At the east side of the building is the engine and dynamo room built on as an addition and it is one of the neatest power plants to be seen in railway shops. The engine equipment consists of a 200 horse power Bullock-Corliss engine for the shop and three electric light engines, a 150 and 50 horse power Buckeye, and a 100 horse power Ideal engine running two 80 and one 40 light arc dynamos, and two incandescent machines for about 1,900, 16 candle power lamps.

The arrangement of machinery in the shop is such as to keep work which is related to other work in as small a floor space as possible so as to prevent unnecessary handling of material, and the repair work is divided up into stations in such a way as to keep all the work of a class together; for instance, the bolt machines are grouped near the north entrance of the building, beyond these are the rod, piston rod, link and piston stations with the necessary machinery which includes a large Newton horizontal milling machine, a vertical milling machine, and a 2 x 24 in. Jones & Lamson flat turret lathe which is reported by Mr. Luttrell to be capable of turning out as much work as four bolt machines. A new Pond wheel lathe was seen, 79 inch. In passing the office of the general foreman of the locomotive department, a telephone was noticed which had below it a switch with 12 points for the purpose of connecting to eleven other offices about the works, and by means of this system the master mechanic may put himself into communication with all of his subordinates. The system is found to be a great time saver.

Upon entering the tool room a large annunciator board was noticed which is connected with about a hundred stations about the shop. Push buttons are located at the large machines which are numbered to correspond, or in case of a number of small machines being grouped together, a station includes several. When the men working upon the machines are in need of tools or appliances from the tool room a boy is called, by means of the annunciator, to take the check of the workman in exchange for the tool desired. There are about half a dozen boys and they are kept busy. The men do not return the tools but call the boys who carry them back to their places in exchange for the checks again. The boys are paid 7 cents an hour and the saving is apparent from the difference in the wages of men and of the boys. The system works admirably. The tools are procured more promptly than if the men were obliged to go after them, and the possibility of spending unnecessary time at the tool room is entirely avoided. There is no crowd of men waiting at the window. The tool room equipment is exceedingly complete and includes two large emery wheels upon which men are continually employed in the grinding of lathe, planer and other tools, all of this work being done at this point by expert workmen. This plan is of equal value with the annunciator system and there seems to be no objections to either.

The brass work, air brake repairs and injector work are all carried out in the near neighborhood of each other and the work upon the small parts is received on a rack where it is placed by the laborers who bring the parts from the engines as they are stripped. The finished parts are placed upon benches and the presence of the pieces thereon is indication to the gang foreman that the work is ready. The apparatus for air brake and signal testing is complete and includes sectioned apparatus for the benefit of the locomotive runners who may wish to study the air brake during the absence of the regular instruction car. A useful piece of apparatus was devised by Mr. Luttrell for testing injectors. This consists of the necessary piping and gages for running an injector under the same conditions under which it operates on a locomotive and at the same time reading the pressure against which it is working. The attachments may be easily made and it is found to be very useful. The shop is equipped with the air tools usually employed and also with a number of hoists. A traveling hoist is now being constructed which will serve a large number of the heavier lathes and planers. The erecting shop was arranged with a view of putting in an overhead traveling crane above the pits, but this has not yet been erected.

The blacksmith shop and boiler shop are situated in the same building, which stands adjacent to the locomotive machine shop. Here pneumatic tools are employed to good advantage, and an interesting punch was noticed which was used for punching the rivet holes in locomotive lagging. This was made from a triple valve, and a larger punch is now under construction which will have sufficient power to handle material for ash pans. In the forge shop Mr. Luttrell has placed water screens in front of the bolt furnaces so arranged as to keep their fronts cool, which contributes greatly to the comfort of the men. This arrangement consists of a sheet iron screen placed about one inch from the outside face of the brickwork of the furnace and over which water is allowed to run from a series of jets at the top. The film of water thus passing over the surface keeps it cool and prevents the radiation from the brick work from reaching the men. The water is drained back into the source of supply, which is a large sump in the yard, the pressure for the jets being obtained from an elevated tank. No hand forging whatever is done upon the car work, all being performed by power machines in the form of belted bulldozers, or by machines composed of old air brake cylinders and driven by pneumatic power. A new extension was built upon the blacksmith shop at the time of the construction of the new buildings of the car department in 1895.

The store and oil houses constitute points of special interest, but will not be treated here for lack of space. We are indebted to Mr. Wm. Renshaw, su-

perintendent of machinery; Mr. J. W. Luttrell, master mechanic, and Mr. F. W. Brazier, general foreman car department, for the visit to the works.

TELEGRAPHS ON ENGLISH RAILWAYS.

A summary of a paper read by Mr. Langdon before the Institution of Electrical Engineers, entitled, "Railway Telegraphy," was given as follows in a recent issue of Engineering of London:

Since the general adoption of the block system on our principal lines, railway telegraphy has made giant strides. Thus Mr. Langdon, in his interesting paper recently read before the Institution of Electrical Engineers, estimates that there were 27,204 miles of wire employed for railway purposes in 1869, which in 1894 had grown to upwards of 99,000 miles. The rate of increase is still being maintained mainly owing to the gradual adoption of electric interlocking, which is being introduced more or less rapidly on all the principal lines of the kingdom. This increase in the length of wire has been further emphasized by the needs of the postoffice, for whom the railways have now erected some 67,000 miles of wire. Under these conditions the carrying capacity of a single post has proved inadequate, and has been, where necessary, increased by adding a second line of poles alongside the first set, the two being roughly braced together to form a so-called H-pole, the the insulator arms extending across both posts. Wooden poles seem to be used practically exclusively on British lines, and when properly seasoned and creosoted there seems no limit to the life of them. Mr. Langdon states that it is a mistake to charge the wood completely with creosote, an allowance of 8 lbs. per cubic foot being ample. With this proportion the sapwood will be completely charged, while the heartwood will be practically unaffected. If the whole body of the post is filled with creosote, it becomes brittle. Several cases are on record in which creosoted posts have been found perfectly sound more than thirty years after erection.

Though, as already stated, iron has not been much used for poles by the railway companies, this material is being introduced for the arms on the Midland Railway. These arms are 40 in. long, and consist of $1\frac{3}{4}$ in galvanized iron tubing $\frac{1}{8}$ in thick strengthened in the middle by a sleeve of tubing 2 in. in diameter, also galvanized. The grooves cut in the poles for these arms are slotted out as for a rectangular arm, the bottom of the slot being fitted to the surface of the tube. Stranded wire is now universally used for stays which are fitted not only so as to prevent the possibility of the poles falling sideways, but every tenth pole or so is also stayed in a longitudinal direction, forming an abutment pole. Before this precaution was adopted, instances have been known of 30 or 40 miles of line going down together. In this case the wires had broken in some intermediate span, the adjacent ones being then unsupported longitudinally also fell, the process being repeated in the next span until the damage was arrested in each direction by some solid abutment. In erecting the wires care has to be taken to vary the tension according to the temperature, as otherwise lines put up in hot weather would be liable to snap in cold.

Copper wires seem to be gaining in favor, though the initial cost of equivalent wires is nearly double that of iron, a No. $12\frac{1}{2}$ copper wire costing 4.4*l* per mile, whilst a No. 8 galvanized iron wire costs only 2*l* 10 s. The life of the latter in many districts is, however, very short, being estimated by Mr. Spagnoletti at but $3\frac{1}{2}$ years in certain districts in South Wales, and at four to five years in the Birmingham district. In open country, however, it has been known to last more than 30 years. The iron wire is of greater strength than the copper with which it is replaced, and does not accumulate a heavy load of snow, so that it might be expected to break less often than its more modern rival, but Mr. Langdon claims that the frequency of such accidents has not increased with the adoption of copper. A slight modification has recently been made in the joints for wires, the "tails" being no longer turned up, as it is considered better that the joint should draw than form an intermittent fault. Leading-in wires are covered with gutta-percha. The single-needle instrument is still most generally used, though the sounder has been adopted on the Irish lines. As regards batteries, the Daniell cell has been superseded by the bichromate or Leclanche, the former being preferred for hard and constant work.

A LARGE DIMENSION SURFACING AND JOINTING MACHINE.

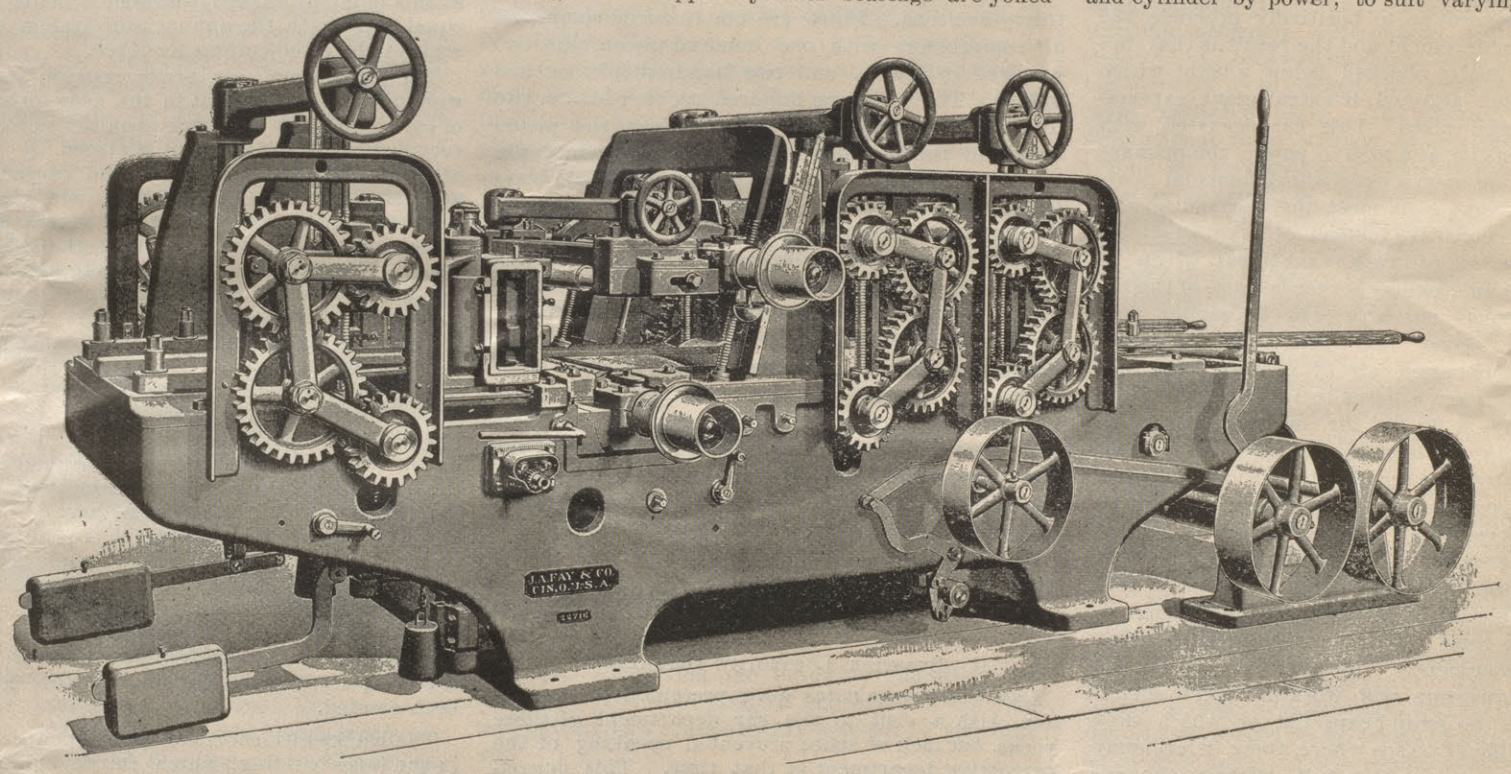
The No. 12 six roll dimension surfacing and jointing machine, by J A. Fay & Company, shown in the accompanying illustration, was designed to meet the requirement for a specially heavy machine with roll feed, adapted to planing dimension timbers on four sides at one operation, as well as every variety of surface planing. It is the heaviest and most substantial timber planer yet introduced by that concern. The frame is massive in construction, with plate sides, and well braced to prevent any vibration when working to its full capacity. It will surface on two or four sides up to 30 in. wide and 14 in. or 16 in. thick as may be ordered, and will plane two sides and one edge of two pieces of material up to 13 in. wide, 14 in. or 16 in. thick. By the use of sectional feeding rolls and bars a number of narrow pieces of varying thickness may be surfaced on both sides at one time.

The cylinders with their journals are made of forged crucible steel. They are slotted on all four faces and are provided with journals 3 in. in diameter, ground true, running in heavy 12 in. self oiling bearings. The upper cylinder bearings are yoked together and held true with the stands by gibs on each side in addition to a groove planed true to keep them always in line. A device for locking the cylinder is arranged and operated from the feeding end of the machine. The lower cylinder is mounted in a connected frame that can be drawn out on the operating side to permit of ready access to the knives. It is held rigidly in position by an improved locking device. It has an independent vertical adjustment, and is placed in front of the side heads and as close to the upper cylinder as possible, bringing the cuts of both cylinders very close together, insuring uniformity in thickness of the finished work.

The pressure bar in front of the cut is made sectional and is adjustable to and from the cut. It is arranged to lift easily for any variation in thickness up to three inches. The bar behind the cut of the upper cylinder also serves as the pressure bar over the lower cylinder. It is adjustable to and from the cut of the upper cylinder and has an independent vertical adjustment. There are two pressure rolls, one in front of and one behind this bar, used in planing heavy timbers, the bar itself raised out of the way to relieve the material from friction. These rolls are arranged to vary the pressure. As the bar is supported to the cylinder frame it needs no changing when varying the thickness of the cut, for after once being set it always holds the same relation to the cut.

The side spindles are $2\frac{3}{16}$ in. in diameter where the heads are applied and are of steel. They run in three self lubricating bearings, one being at the top, above the heads, thus insuring steady running. The top bearing can be quickly removed for the purpose of changing heads. The side heads are made of steel, slotted on four faces, and are furnished 14 in. or 16 in. long, as desired. The side hangers are supported on heavy girts, and are held by a positive lock controlled either from the feeding end of the machine or from the operating side. They are also adjustable across the machine from the feeding end or from the side. Each head is provided with an improved adjustable weighted clip, permitting the chip breaking lips to be brought close to the cut. By simply loosening two bolts the entire clip can be removed, giving free access to the knives. The necessary pressure feet are furnished for holding the material true to the hanger plates, these plates being adjustable to suit the cut of the lower cylinder. The side guides at the feeding out end of the machine are arranged to move with the hangers.

The feed-rolls, six in number, are 10 in. in diameter. The upper feeding-in rolls are made sectional to allow narrow material of different thicknesses to be fed through the machine at the same time. These rolls are supported on large bearings, carried in swivel boxes. They have heavy expansion gearing at each end, yoked both inside and out. The rolls are heavily weighted, the equalizer-weights being placed so as to drop on cushions which relieve the strain and overcome the tendency to shear the fulcrum-bolts. A lever is attached to the operating side of the machine by which the upper rolls can be instantly lifted clear of the lumber. The lower rolls are provided with the necessary means of vertical adjustment. At the feeding end of the machine an attachment is provided for raising the upper rolls and cylinder by power, to suit varying thicknesses of material that are being planed. It is operated by a lever. and a gage is attached which accurately gages every position, and is easily controlled by the operator.



A LARGE DIMENSION SURFACING AND JOINTING MACHINE.

All the upper rolls and upper cylinder can be raised together, or the upper cylinder and feed out roll can be disconnected and adjusted by hand if desirable. The feeding power is applied to the rolls by means of a variable friction feed, regulated from 5 ft to 110 ft. per minute. This feed is separate from the framing of the machine, and may be placed either overhead or under the floor, as may be desired. It is under control by the operator by means of two levers, one for starting it and one for shifting the the friction plate for different rates of feed. By sufficient movement of the lever that actuates the friction plate the feed may be instantly reversed and the material fed back out of the machine. The countershaft is provided with tight and loose pulleys 14 x $10\frac{1}{2}$ in. and should make 900 revolutions per minute. The machine weighs 24,500 lbs. Further information in regard to this machine may be had by addressing the manufacturers at 299-319 West Front Street, Cincinnati, O.

THE CONVENIENCE OF COMPRESSED AIR.—Writing in the Tradesman, of the manifold uses of compressed air, and the comparative inexpensiveness of equipping for its use, James F. Hobart says: The shop which never has had compressed air in it has lost a great convenience. Only

the mechanic who has compressed air at hand at all times can be aware of the time and labor saving qualities of this excellent appliance. A small air compressor run by belt and capable of compressing air to 60 or 70 lbs., is not an expensive piece of machinery, neither is it costly to operate. With the necessary oiling and care of belts, etc., such a compressor will run from year to year with little if any repair. The air should be piped around the shop, and a service plug placed at each bench. It can be used by means of small holes. It is handy for cleaning castings aided by a scratch brush. It will also blow the dust out of work, aid the blow pipe in soldering, the band sawyer in brazing his saw and the painter in distributing his colors. Compressed air is always excellent for building fires either under the boiler, in the blacksmith's forge or in a stove. Even in the foundry cupola compressed air builds a fire very quickly with the aid of a small piece of oily cotton waste and a few bits of soft coal. It dispenses altogether with the blacksmith's ugly bellows or blower. It will also enable a man to start a small brass foundry almost anywhere in the shop where he chooses to rig up a few bricks and a little soft clay. A sand blast may be rigged up for cutting or lettering glass, clean the files, cutting the sand off castings, or for hundreds of similar operations. Such a sand blast necessitates only a few pieces of sheet iron and pipe. Indeed, space enough to enumerate the various applications and labor saving uses of the sand blast in the shop could not be taken in several issues. Try it once and you will never be without compressed air in the shop.

COST OF AIR BRAKE RIGGING.

To the Editor of the Railway Review:

I note the article in your issue of July 25 relative to the cost of air brake forgings as made in a railroad shop. The prices are indeed very creditable, and in my opinion they are considerably less than those for which they can be turned out in the average railroad shop. I have figures showing that it has cost 3 cents per pound, which will correspond with the usual cost where the holes in the levers are drilled. Some roads, however, are punching their levers, which I consider bad practice, and are thus able to reduce the cost of their forgings considerably by this means, for the drilling with the ordinary drill press increases the cost materially.

We had occasion to order through a house in this city forgings for ten Southern iron box cars, and the cost for the complete forgings delivered in Atlanta was $10.70 per car, you will note by the blue prints inclosed that there are several more forgings of a more complicated character than are used with a wooden car. I am advised that for a larger quantity lower prices can be given than above noted. I believe that Mr. Parke was in the main right in his statements that air brake forgings can be purchased from manufacturers for considerably less cost than railroads can manufacture them. Yours truly,

E. M. ROBERTS,

Southern Iron Car Line, Atlanta, Ga., July 28, 1896.

THE FREEZING OF GAS.

Since gas began to be adopted generally for lighting purposes it has been the aim of gas engineers to prevent the freezing in of gas pipes. Until recently it has been the general opinion that the moisture always present in lighting gas caused the freezing in by its separation in frost-like form, and all the methods known so far to prevent this are based upon the principle of removing the moisture in the gas before its entrance into the conduit pipes. The method formerly employed to reach this purpose was that the gas was exposed in so-called "freezing-out" cylinders to the cold, whereby, of course, the drying of the gas was obtained. But, as in the freezing-out cylinder, not only the moisture contained in the gas, but also large quantities of the light-giving carburated gases were separated, the frozen out gas showed such losses of lighting power that the practical employment of this method was hardly possible.

An extraordinarily simple and cheap method to dry the lighting gas by means of sulphuric acid of certain concentration was patented by the German Continental Gas Company two years ago, and proved quite satisfactory in the beginning. In the last hard winter, however, the chandeliers and conduits froze in again, although the gas entered the distributing pipes entirely free from water, and an investigation showed that the pipes were perfectly stopped up by frost-like formations in the same manner as if undried gas had been used. There was only the difference that these formations did not consist of frozen water, but of frozen, almost chemically pure, benzol.

This discovery shattered at once the former opinion that the freezing in of the pipes was caused by moisture contained in the gas, and the author very soon discovered a method by which not only the freezing of the moisture, but also of the benzol was made impossible. The principle of this method is, that in the gas works and behind the gas meter, a certain quantity of alcohol vapor is added to the gas. The effect of this alcohol vapor is shown in the fact that, if, by the action of the cold, separations of water and benzol occur, the alcohol vapor carried along also separates, whereby the freezing point of these separated condensations of water and benzol is forced down so much that they will not congeal even at our coldest temperature in winter, but remain in liquid condition. They can, therefore, flow back to the main conduit and from there into the next condensing pot. A stopping up of the gas conduit by separation of solid condensations is made impossible in this manner.

The action of the alcohol vapor added to the gas is here an altogether different one of that caused by injecting liquid alcohol into frozen up pipes. By my method a means is furnished to prevent freezing in

FIG. 1.—COMBINATION BICYCLE ON RAILWAY.

altogether, while in the former use of alcohol in the gas works it was but intended to thaw up conduits that were frozen in already.

In the last hard winter it was shown by experiments that the action of the alcohol vapor added at the gas works is still effective at a distance of three miles—that is, the alcohol vapor remains in the gas. The action of the alcohol vapor, however, is stopped as soon as the gas has passed a wet gas meter. In the case of large establishments a small apparatus for evaporating alcohol can be provided behind the gas meter.

For practically carrying out this method a small evaporator of ordinary construction heated by steam or a little gas flame, is used, into which the alcohol from a higher placed tank flows in a fine, instantly

FIG. 2.—COMBINATION BICYCLE ON HIGHWAY.

evaporating stream. The hot alcohol vapor is conducted through a little pipe into the gas main and at once absorbed by the gas.

In order to obtain the desired effect about 5 grammes of 95 per cent denaturated alcohol must be added per one cubic meter; at very low temperature, about 10 to 20 degrees below zero, this amount must be increased by one or two grammes. In most cases it is sufficient to commence with evaporating alcohol about half an hour before the street lamps are lit, while the addition of alcohol in the day time would appear to be necessary in exceptional cases only.

This method was employed on a large scale last winter in the gas works at Dessau, where it has given excellent results. Its advantages must not be looked for in the saving of alcohol; on the contrary, in most cases more alcohol is consumed than in the old method, which aimed only at the removal of obstructions produced by freezing it. The great advantages of the new method are found in the saving of wages, and, above all, in the entire removal of interruptions in the distributions of gas, which usually occur when most disagreeable—that is, in the winter, and which are apt to discredit gaslighting during that season. —[Exchange.

COMBINATION HIGHWAY AND RAILWAY BICYCLE.

The accompanying illustrations show the general appearance of an attachment for bicycles for adapting them for use on railway tracks as well as highways, which is ingenious and seems to have merit. The attachment consists of three guide wheels and the guides and supports necessary for attaching them to an ordinary bicycle in a manner that will keep the wheel directly on the center of the rail of a railroad track. The illustration Fig 1 shows the machine with the attachment in place and the bicycle on a railroad track. When it is desired to use the wheel on a highway the attachment can be entirely removed or can be folded up and carried on the wheel as shown in the illustration Fig. 2. It is stated that the attachment complete weighs only 15 lbs. and an ordinary wheel with attachment will weigh less than 50 lbs. The length of time required for adjusting the attachment on the wheel is given as five minutes, for removing it one minute, and for folding it up and securing for highway riding as shown in Fig. 2, five minutes. The plan is to construct the machine so it will be of use particularly to telegraph and telephone line repair men and for this work a wire reel is carried upon the rear fork of the attachment and the necessary tools are carried in a satchel suspended in the frame of the bicycle. For the repair of long distance telephone lines which follow both railways and highways, it is believed that this machine and attachment will be particularly useful. It is claimed that a speed of 25 miles per hour can be attained on the machine and the inventor states that he can maintain without fatigue a speed of 18 or 20 miles. Further information regarding the attachment may be obtained by addressing Mr. C. H. Garvey, Anderson, Ind.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.

The above named organization has issued the following notice of its annual convention.

The twenty-seventh annual meeting of the Master Car and Locomotive Painters' Association will be held in New York City on the 9th, 10th and 11th days of September, 1896, convening at 10 o'clock a. m., on Wednesday, the 9th, at the Park (4th) Avenue Hotel, which has been chosen as the official headquarters of the association.

The local committee of arrangements has secured a special rate of $3.00 per day, American plan, and those who expect to attend the convention are requested to engage rooms at an early day, stating length of time the room is wanted, and, to avoid any disappointment, those engaging rooms should request the proprietors, Wm. H. Earlie & Son, to send them the number and location of room.

The demand for economy in the painting of railway equipment is becoming more general each year and it is the duty of every member of this association to inform himself more fully on the modern methods and practice of painting cars and locomotives at the different shops throughout the country, and your attendance at the convention goes to show that you are in search of information, which can be only obtained by mingling together at the annual meetings. Therefore the association most cordially extends an invitation to all foremen car and locomotive painters throughout the States and Canada to meet with them in New York at their Twenty-seventh annual convention.

Committees who have subjects assigned them, as shown on the list below if unable from any cause to be present at the meeting will forward a typewritten copy of their report to the secretary, at least ten days before the date of meeting:

LIST OF SUBJECTS.

1. THE APPLICATION OF COMPRESSED AIR IN BURNING OFF CARS.—G. R. Cassie, Lake Shore & Michigan Southern Ry., Adrian, Mich.; (advance paper in Railroad Car Journal); G. H. Worrall, Boston & Maine R. R., Somerville, Mass.; Henry Block, Cleveland, Cincinnati, Chicago & St. Louis Ry.; Brightwood, Ind.

2. THE CAUSE AND PREVENTION OF THE FLATTENING OF VARNISH ON COACHES AND ENGINES.—Robt. McKeon, Erie Railroad, Kent, O., (advance paper in Railroad Car Journal); W. E. Hibbard, Boston & Albany Railroad, Allston, Mass.; B. F. Murphy, Wilmington & Weldon R. R., Wilmington, N. C.

3. IS IT ADVISABLE TO PAINT LOCOMOTIVE JACKETS, EITHER PLANISHED IRON OR BLACK STEEL? IF SO, WHICH IS THE BEST AND MOST ECONOMICAL METHOD?—W. J. Josenhans, Pittsburgh, Fort Wayne & Chicago Ry., Allegheny, Pa.; (advance paper in Railroad Car Journal); C. W. Mason, Pennsylvania Railroad, Altoona, Pa.; T. H. Soley, Lehigh Valley Railroad, Wilkesbarre, Pa.

4. ESSAY "PAINTING GALVANIZED IRON."—E. A. Cole, J. G. Brill Car Co., Philadelphia, Pa.

5. CAN A COACH BE PAINTED TO MEET THE NECESSARY REQUIREMENTS WITH FOUR COATS OF PAINT, OR AS OTHERWISE TERMED, THE ENAMEL PROCESS, AND RETAIN THE SAME GENERAL APPEARANCE AND DURABILITY AS WHEN PAINTED UNDER HERETOFORE PREVAILING METHODS?—F. S. Ball, Pennsylvania Railroad, Altoona, Pa., (advance paper in Railroad Car Journal); C. E. Copp, Boston & Maine R. R., Lawrence, Mass.; Samuel Brown, New York, New Haven & Hartford R. R., Boston, Mass.

6. THE PRACTICAL PAINTING OF A LOCOMOTIVE.—T. M. Dunlap, Baltimore & Ohio R. R., Pittsburgh, Pa. (advance paper in Railroad Car Journal); D. A. Little, Pennsylvania Railroad (Juniata shops), Altoona, Pa.; Thomas Jones, Canadian Pacific Ry., Montreal, Que.

7. ESSAY. IS IT GOOD POLICY TO HOUSE PASSENGER CARS AT TERMINALS? IF SO, CAN OUR COMPANIES AFFORD IT?—J. A. Gohen, Cleveland, Cincinnati, Chicago & St. Louis Ry., Indianapolis, Ind.

8. WHICH IS THE BEST METHOD OF PAINTING SUPERHEATED PARTS OF LOCOMOTIVES, VIZ.: DOMECASINGS, CYLINDERS, STEAM CHESTS AND EXTENSION FRONTS.—A. J. Bishop, Northern Pacific Ry., St. Paul, Minn.; A. P. Dane, Boston & Maine R. R., Boston, Mass.; Aug. Wolter, Louisville, New Albany & Chicago R. R., Lafayette, Ind.

9. WHICH IS THE MOST ECONOMICAL AND DURABLE, A SANDPAPER OR A PUMICE STONE SURFACER?—G. R. Cassie, Lake Shore & Michigan Southern Ry., Adrian, Mich.; W. T. Leopold, Central Railroad of Georgia, Savannah, Ga.; J. H. Pitard, Mobile & Ohio R. R., Whistler, Ala.

10. SPONTANEOUS COMBUSTION IN THE RAILWAY PAINT SHOP. ITS CAUSE AND PREVENTION.—W. O. Quest, Pittsburgh & Lake Erie R. R., McKee's Rocks, Pa.

11. REPORT FROM COMMITTEE ON TESTS.—W. O. Quest, Pittsburgh & Lake Erie R. R., McKee's Rocks, Pa.; J. H. Pitard, Mobile & Ohio R. R., Whistler, Ala.; J. H. Winters, Wabash, St. Louis & Pacific R. R., Moberly, Mo.; J. A. Putz, Wisconsin Central R. R., Stevens Point, Wis.; C. B. Harwood, Chesapeake & Ohio R. R., Huntington, W. Va.

QUERY LIST.

1. What is the best method, economy, finish and durability being considered, to do car trucks and steps; to clean and varnish; or clean and give one coat of varnish color or oil paint?

2. What is the best formula for a truck and step color, for a passenger equipment car painted Pullman body color, economy, appearance and permanence being considered?

3. How often, on an average, should passenger equipment roofs be painted? Should they be painted for the sake of appearance every time the bodies are varnished, which is about once a year, and what is the best material?

4. What objection, if any, is there to painting passenger coach end doors outside with the body color (providing that it is a dark color) instead of finishing them in the natural wood and keeping it up? Is it not in the interest of economy, considering the abuse the lower portion gets by kicks, which is easily remedied with a coat of color before varnishing?

5. Would one be justified in sanding the bull nose on the roof of a coach for durability's sake.

6. Is it advisable for the association to employ a practical chemist so that if any member in good standing desires a test made he is at liberty to send to him?

7. What would you recommend as a limit for the number of apprentices in the paint shop?

8. Is it advisable to bronze the seat back hangers in a coach? If not, what would you recommend?

Air Motor Cars in New York City.

The trials of the air motor cars on the Third avenue line in New York are stated to have been entirely successful, and the new motors had been so much talked about that much was expected of them. They were tried July 30, and a number of trips were made early in the morning and late in the evening of that date. The following report has been received:

The cars were run back and forth on 125th street several times from North river to the Harlem river, a distance of four miles, and were run at varying speeds of from four to fifteen miles an hour. Each car was completely under the control of the motorman, and started and stopped with ease. There was no jerking. Each car is supplied with a sandbox which dumps a quantity of sand on the track when emergency requires that the car be stopped with more than usual quickness. Sand was tried when the car was moving at the rate of 12 miles an hour and the car was stopped in a little more than its length. The compressed air reservoir had a pressure of 2,000 lbs. to the square inch when the car started on the trip, and the pressnre was reduced one-half when the car had completed its journey of eight miles. It is estimated that the reservoir will hold enough compressed air to propel the car a distance of fifteen miles. In appearance the cars are the same as the cable cars, all of the machinery being beneath the car.

The cars are running in regular traffic and further reports will be looked for with interest. Mr. Henry D. Cooke, general manager of the American Air Power Company, writes that he is satisfied that these cars can be operated and maintained at less cost than other systems, and a low cost of installation is also reported to have been attained.

TECHNICAL MEETINGS.

The American Society of Civil Engineers holds meetings on the first and third Wednesdays in each month, at 8 p.m., at the House of the Society, 127 East Twenty-third street New York City.

The Association of Civil Engineers of Cornell University meets weekly every Friday, from October to May inclusive, at 2:30 p. m., at Lincoln Hall, New York.

The Boston Society of Civil Engineers, meets monthly on the third Wednesday in each month, at 7:30 p. m., at Wesleyan Hall, 36 Bromfield street, Boston, Mass.

The Canadian Society of Civil Engineers meets every other Thursday at 8 p. m., at 112 Mansfield street, Montreal, P. Q.

The Foundrymen's Association meets monthly on the first Wednesday of each month, at the Manufacturers' Club, Philadelphia, Pa.

The Montana Society of Civil Engineers meets monthly on the third Saturday in each mouth, at 7:30 p. m., at Helena, Mont.

The New England Railroad Club meets on the second Tuesday of each month, at Wesleyan Hall, Bromfield street, Boston, Mass.

The New York Railroad Club has a monthly meeting on the third Thursday in each month, at 8 p. m., at 12 West hirty-first street, New York City.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m., at the St. Paul Union Station, St. Paul, Minn.

North-West Railway Club meets alternately at the West Hotel, Minneapolis, and the Ryan House, St. Paul, on the second Tuesday of each month.

The Engineering Association of the South meets on the second Thursday of each month at 8 p. m., at the Cumberland Publishing House, Nashville, Tenn.

Annual meeting Traveling Engineers' Association, Minneapolis, Minn., Sep. 8, 1896. W. O. Thompson, secretary 415 Marion street, Elkhart, Ind.

Annual Convention Roadmasters' Association and Road and Track Supply Association, Cataract Hotel, Niagara Falls, N. Y. second Tuesday in September, 1896.

The Railway Signaling Club holds its meetings in Chicago, Ill., on the second Tuesday of January, March, May, September and November. G. M. Basford, secretary, 818 The Rookery.

The Southern & Southwestern Railway Club holds its meetings on the third Thursday of January, April, August and November, at the Kimball House, Atlanta, Ga.

The Western Foundrymen's Association holds its meetings on the third Wednesday in each month, at the Great Northern Hotel, Chicago, Ill.; secretary, S. T. Johnstone, 1522 Monadnock building.

The Technical Society of the Pacific Coast has a monthly meeting on the first Friday in each month at 8 p. m., at the Academy of Sciences building, 819 Market street, San Francisco, Cal.

The Engineers' Club of Cincinnati has a monthly meeting on the third Thursday in each month, at 7:30 p. m. at the Literary Club, 24 West Fourth street, Cincinnati, O. Address P. O. Box 333.

The Engineers' Club of Minneapolis holds its meetings on the first Thursday in each month, at Public Library building, Minneapolis, Minn.

PERSONAL.

Mr. Nat Duke has been appointed general westbound traveling agent of the Nickel Plate Line, with headquarters at Buffalo.

Mr. J. P. Head has been appointed roadmaster of the Texas Central. He was formerly in the bridge and building department.

Mr. J. W. Lovett, of the Southern Railway, has been appointed superintendent of bridges and buildings of the Georgia Midland.

Mr. B. E. Moody has been appointed superintendent of the Greenwood Lake division of the Erie, with headquarters at Jersey City.

The president has appointed Mr. John Sheridan, of West Virginia, to be a Goverment director of the Union Pacific Railway Company, vice Mr. Fitzhugh Lee, resigned.

Mr. H. M. Emerson, for several years assistant general freight and passenger agent of the Atlantic Coast Line, has been appointed general freight and passenger agent of that system.

Mr. R. B. Hartshorn has resigned the office of treasurer the Minneapolis & St. Louis, owing to ill health and is succeeded by Mr. F. H. Davis, late assistant secretary of the Southern Pacific.

Mr. John G. Taylor, formerly chief dispatcher on the Montana division of the Great Northern, has been appointed superintendent of the Wilmar division of that company, vice O. O. Winter, resigned.

Mr. H. C. Jewett has been appointed soliciting agent for the Lake Shore at Toledo, O. Mr. Jewett has been in the Lake Shore office for four or five years, where his excellent work won for him the promotion.

Mr. H. B. Wood has been appointed traveling freight agent of the Columbus, Sandusky & Hocking. Mr. Wood was formerly city freight and passenger agent of the Cleveland, Akron & Columbus at Columbus.

Col. D. S. Wagstaff, formerly the Grand Trunk division passenger agent in Detroit, has been made general agent of the Cincinnati, Hamilton & Dayton, with headquarters in Detroit. The appointment will take effect August 15

Mr. J. W. Fortune, for the past twelve years identified with the Chicago & Grand Trunk Railway, as assistant general manager, has severed his connection with that road. It has been rumored that Mr. Fortune would go to the Wabash.

Mr. H. F. McFarland, who has been assistant freight agent of the Chesapeake, Ohio & Southwestern Railroad, has assumed the position of general freight agent of the Galveston, Houston & Henderson Railroad, with headquarters at Galveston.

Mr. C. H. Walton, superintendent of the Chicago division of the Panhandle, it is understood, will be appointed general superintendent of the Grand Rapids & Indiana. Mr. T. S. May, trainmaster, will succeed Mr. Watson as division superintendent.

Mr. J. N. Vining, one of the oldest railroad men in the south, and one who worked himself up from the position of track hand to the treasureship of the Central of Georgia, which position he held for ten years, died at East Point, Ga., Monday last, of paralysis, aged 72 years.

Mr. Sam G. Hatch, who has been general passenger agent of the Chesapeake, Ohio & Southwestern road, has been appointed division passenger agent of the Illinois Central, with headquarters at Cincinnati. Mr. Hatch will assume the duties of his new position in a few days.

Mr. William W. Borst was on July 30 appointed receiver of the Denver, Lakewood & Golden railroad by Judge Hallet in the United States district court, on application af the Farmers' Loan & Trust Company of New York. The company is in default on the interest on $627,000 bonds.

Mr. Chas. G. Thayer has resigned the position of assistant general freight agent of the Dunkirk, Allegheny Valley & Pittsburgh Railroad, and the office will be abolished. All communications pertaining to the freight department will hereafter be handled in the superintendent's office.

Mr. J. H. Hill, who was some time ago selected as manager for the Galveston, Houston & Henderson, but who owing to some disagreement did not take the position, has now been confirmed by the directors and the road has been turned over to him. Mr. Hill's headquarters are at Galveston, Tex.

Mr. E. H. Hoar, the Minneapolis agent of the St. Paul, Minneapolis & Omaha, has been appointed to succeed O. W. Winter as superintendent of the Brainerd & Northern. Mr. Hoar's headquarters will be at Brainerd. Mr. Winter was recently appointed assistant general superintendent of the Great Northern.

The title of Assistant General Passenger Agent Fred E. Fisher, of the Ohio Southern and Lima Northern, has been raised to general passenger agent. In 1892 Mr. Fisher accepted the position of traveling passenger agent of the Ohio Southern, and in the latter part of the same year he was made assistant general passenger agent.

Mr. W. F. Lord, heretofore commercial agent of the Wisconsin Central Lines at St. Paul, is appointed general agent for St. Paul, an office established by the changes incident to the promotion of Mr. F. A. Greene to Duluth. Mr. Green's former assistant to Mr. Herman Brown will succeed to the office of city passenger and ticket agent.

Mr. J. M. Dickinson assistant Attorney General of the United States, has accepted the position of chief counsel of the Nashville division of the Louisville & Nashville road made vacant by the resignation of the Hon. Ed Baxter, who will remove to Washington to represent the Association of Southern Railroads before the United States Supreme Court.

General Freight Agent D. E. McMillan of the Columbus, Sandusky & Hocking has issued a circular appointing Mr. E. C. Winstanley commercial agent of the company, with headquarters at Detroit, Mich. This office with Mr. Winstanley in charge was opened up during Mr. Guerin's former administration but was abolished by Mr. Monsarrat when he took charge of the road.

Mr. R. B. Pegram, Jr., now chief clerk to Commissioner James S. Davant of the Memphis Freight Bureau will be chief clerk to Mr. W. L. Smith, who has just been appointed to succeed Mr. Hurlbut as assistant general freight agent of the Illinois Central. Mr. Pegram is very young to hold such an important position and his selection by Mr. Smith is a pronounced compliment to his ability.

Mr. J. C. Knapp, who for a number of years was chief clerk to General Passenger Agent Rinearson of the Queen & Crescent system, has taken service with the Southern States Passenger Association as secretary. Mr. J. E. Rockwell, who retires, was at one time chief clerk of the Southern Railway and Steamship Association, and has been with the Passenger Association for the last two and one-half years.

The announcement has been made that Mr. E. E. Elmore, formerly chief clerk in the division freight agent's office of the Texas & Pacific, has accepted the position of general superintendent of the Mansfield road, with headquarters at Mansfield, La. This Mansfield road is a very short line, but is an important feeder to the Texas & Pacific road, on which account it is carefully looked after by the latter's officials.

Mr. W. H. Tayloe, who has held the position of district passenger agent at Atlanta, has been made general agent of the passenger department at Norfolk, Va., between which point and Baltimore the Southern Railway has recently established a steamship connection. He will probably be succeeded by Mr. W. D. Allen, at present passen-

ger agent with headquarters at Jacksonville, Fla., although it is not yet officially announced.

It is reported that Mr. O. W. Winter, formerly superintendent of the Breckenridge division of the Great Northern with headquarters at Minneapolis will soon be appointed assistant general superintendent of the Great Northern. There is also a prospect, it is said, that the duties of Car Accountant C. H. Cannon of the same road will be divided so as to remove some of the responsibilities of this department to that of the general superintendent.

The vacancy on the Columbus, Sandusky & Hocking caused by the promotion of Mr. Beale from traveling freight and passenger agent to general passenger agent has been filled by the appointment of Mr. C. N. Freeman. Mr. Freeman has been for some time agent at Sandusky and brings to his new position experience gained in his former position and also the help of a wide acquaintance. He will be succeeded at Sandusky by Mr. E. N. Odenbaugh.

Mr. Frank Schledron, who for several years has been general foreman of the machine department of the Louisville & Nashville, has severed his connection with that company and goes away in search of health. One evening this week Mr. Schledron was visited by a party of his fellow workers and employes of the Louisville & Nashville and presented with a beautiful gold-headed umbrella. His position will be occupied by Mr. David Briggs, one of the oldest engineers of the road.

Mr. M. N. Forney, who is well known as a member of the editorial staff of the American Engineer, Car Builder & Railroad Journal, has recently opened an engineering office at No. 41 Cortlandt street, New York, and is prepared to furnish designs and specifications for all kinds of engineering devices and equipment. Mr. Forney is a member of the American Society of Mechanical Engineers and associate member of the American Railway Master Mechanics' and the Master Car Builders' Associations.

Commercial Agent Kendall, of the Baltimore & Ohio, has announced the appointment of Mr. Charles M. Lanning as traveling freight agent. He will cover the territory in the vicinity of Toledo in the interest of the Baltimore & Ohio, and will have his headquarters in that city. Mr. Lanning is at present traveling freight agent for the Grand Rapids & Indiana in Michigan, with which company he has been twelve years. He is considered one of the strongest outside men in his department. Appointment effective August 1.

Mr. Frank A. Greene, city passenger agent at St. Paul, Minn., of the Wisconsin Central, has left for Duluth where he will assume the duties of general agent of the same company at the head of the lakes which is a new position. The change is made principally because with the recent completion of the Manitowoc branch and car ferry line the Wisconsin Central intends to be a more prominent factor than ever before in flour and wheat traffic. No change will be made in the St. Paul office except that the remaining force will have their authority increased and will assume more pretentious titles than heretofore.

Mr. P. J. McGovern, a former Louisville & Nashville man, has taken service with the Southern Railway Company. He goes with the Southern to take charge of the rate department under General Freight Agent Smith, with headquarters at Washington, D. C. When Mr. McGovern left the Louisville & Nashville, he went with the Richmond & Danville as assistant general freight agent and later he was general freight agent of the Georgia Pacific. For the past three years he has been assistant commissioner of the Southern States Freight Association, which position he resigns to take service with the Southern.

Mr. D. C. Moon has been appointed superintendent of the Dunkirk, Allegheny Valley & Pittsburgh Railroad, vice Mr. C. H. Ketcham, resigned, taking effect Aug. 1, 1896. Mr. Moon has been identified with the road since its construction in 1871, starting in as telegraph operator at Moon's station. In 1873 he was promoted to train dispatcher, and was appointed trainmaster by Mr. Ketcham, when the latter assumed the superintendency of the road in 1890. In 1893 when Mr. Ketcham was made superintendent of the western division of the West Shore, he appointed Mr. Moon assistant superintendent of the D. A. V. & P., and he has filled this office to the satisfaction of the New York Central officials ever since.

The following appointments for the Chesapeake, Ohio & Southwestern have been announced by Mr. J. T. Harrahan, second vice president of the Illinois Central, owing to the latter company's assumption of control of the Southwestern which it recently bought at foreclosure sale: C. A. Beck, assistant vice president; A. W. Sullivan, general superintendent; J. F. Wallace, chief engineer; William Renshaw, superintendent of machinery; J. M. Daly, superintendent of transportation; M. Gilleas, assistant general superintendent; M. C. Markham, assistant traffic manager; A. H. Hanson, general passenger agent; F. B. Bowes, general freight agent; William M. Murray is appointed division passenger agent at New Orleans to succeed W. A. Kellond, transferred as assistant general passenger agent at Louisville. W. J. Harrahan is appointed superintendent of the Louisville division between Louisville and Paducah.

A number of changes are to be made on the Great Northern, it is said, and Assistant Freight Agent W. J. Evans of the Eastern division, comprising Minnesota and the Dakotas, will be removed to St. Louis as general agent, succeeding James Robinson, who succeeded J. C. Eden as general agent at the head of the lakes. The general agency at St. Louis has been vacant about two months. Mr. Evan's promotion has also been very rapid, and few freight men of his years could hold such important positions as that he is vacating or that he is taking. He became assistant general freight agent on Jan. 1, 1894, prior to which time he was freight claim agent of the system. For three years he was chief clerk in the claim department. It is also stated that Mr. W. H. Hill, now chief clerk to Vice President Finley, will become assistant general freight agent of the Eastern division. Mr. Hill was chief clerk to Assistant General Freight Agent Gray of the Western division, when Vice President Finley assumed his new position this year. He then became Mr. Finley's chief clerk.

RAILWAY NEWS.

Atlanta, Knoxville & Northern.—The reorganization committee of the old Marietta & North Georgia, or as it is now known the Atlanta, Knoxville & Northern, has until September in which to complete its payments, after which the question of building an extension into Atlanta will be decided. It is stated that overtures have been made by parties owning a route northwest from Atlanta to complete the line from Marietta and turn it over to the Atlanta, Knoxville & Northern Co. at a consideration of about $500,000.

Cincinnati, New Orleans & Texas Pacific.—The Cincinnati Southern Ry., running from Cincinnati to Chattanooga, a distance of 338 miles, is owned by Cincinnati. It is part of the Queen & Crescent system, and has been leased to the Cincinnati, New Orleans & Texas Pacific Ry., the latter company being in the hands of a receiver. The representatives of the Cincinnati, Hamilton & Dayton R. and the Southern Railway have offered a joint bid for the road and its terminals, and August 3 was set to submit the proposition to the people for final action. After the proposition had been favorably passed upon by the board of administration and the sinking fund commission, the vote resulted: Yeas, 15,392; nays, 15,730, the proposition to sell the road being lost by 338 votes, just one vote for each mile of road. Had these roads secured control it would have given the Southern a northern terminus and a lake exit, which would make it one of the most formidable railroad systems in the country, as it is already the largest system in the south. The people of Cincinnati have been taxed to meet the interest on $19,000,000 worth of bonds issued by the road, and as the road is not a particularly good piece of property at present, there was a strong feeling in some quarters that its sale would be best for the city.

Kansas City, Pittsburg & Gulf.—The first train on that section of the Kansas City, Pittsburgh & Gulf road terminating at Mena, Ark., passed over the lines on August 3. It consisted of a locomotive and private car and brought in a party of railroad officials from Kansas City and other points, together with a number of newspaper men and passengers. The Gulf is the first road to tap this country, and the event is the most interesting one to the inhabitants of Mena. Two thousand persons have been camped in the woods about the three-week-old town and several saw a railroad train for the first time in their lives. The distance from Kansas City to Mena is nearly 376 miles. South of Mena the grading and track-laying is going on rapidly, the entire line being now under contract. On the 60 miles of road north of Horatio, Ark., Monroe & Lee, of Lawrence, Kan., contractors, over 3,000 men are reported at work. This was the only important section of the road not under contract, and its completion will afford a connection at Horatio with the 120 miles of the Texarkana & Fort Smith division of the line now completed and in operation. This section is called the Mountain division and is the most difficult to construct of any on the entire line. As soon as it is finished trains will be run from Kansas City to Shreveport, La.

Kansas Midland.—A bill has been filed in the United States circuit court at Wichita, Kansas, to foreclose on the Kansas Midland Co., together with an order from Judge Caldwell appointing Mr. A. L. Woolf of St. Louis receiver of the road. The suit was brought by the Mercantile Trust Company of New York City, trustee for the first mortgage bonds, $1,607,000. The Kansas Midland is a feeder of the St. Louis & San Francisco extending from Wichita to Ellsworth a distance of 106 miles, and was built in 1886.

Northern Pacific.—Another sale of property belonging to the Northern Pacific R. Co. was held on the 4th inst., and comprised the lands in the state of Washington, consisting of 11,902 sections of patented land and an indefinite quantity of unpatented land. The property was bought in by President Winter of the reorganized company for $1,705,000. A private bidder attempted to purchase one tract of 160 acres, but Winter bid it up to $15,000 and took it at that figure. There was no opposition after this. Winter purchased the next tract for $100 and with an option to take the rest of the patented land at the same figure, depositing $119,010 in Northern Pacific bonds. The remaining lands of the company were knocked down to him for a lump bid of $505,000.

Pittsburgh & Connellsville.—The president of the Pittsburgh & Connellsville road, Mr. Orland Smith, has filed a petition in the United States circuit court at Baltimore, asking that $650,000 of the receivers' certificates be authorized by the court, the same to be used in making permanent improvements. The petition alleges that the road is unable to maintain itself and pay its indebtedness, not from lack of business, but because its transportation facilities are so poor that it cannot handle the business. It is proposed among other things to construct terminals at Pittsburgh costing $340,700, to build 6½ miles of second and 7½ miles of third track, costing $143,000, and to construct a new yard at Connellsville at a cost of $72,000. The plan is to make the receivers certificates a lien on the road having precedence over the existing mortgages.

Texas Midland.—Construction on the extension to the Texas Midland is making rapid progress and it is hoped to be running freight trains into Paris by September 1 at the latest. The grading is about completed between Commerce and Sulphur Bottom and ready for the ties and rails which are now being received. During the present week all of the construction force was put on to assist in the work of grading between Paris and Sulphur Bottom. The cost of the Paris extension is estimated at a round million dollars by President Green. The Midland has just purchased one of the largest stone quarries in Texas, which is located nine miles south of Paris. Two hundred men have been put to work on it for the purpose of getting out sufficient stone to ballast the entire line from Paris to Waxahachie. The passenger equipment will be the finest in the state, if not in the south. It will all be new and of the most approved type. The trains will be equipped with electric lights from headlight to danger signal on rear coach. In connection with the Frisco & Central, the Midland will be the shortest line from St. Louis to Galveston and Houston by over 79 miles. The time from Paris to Dallas will also be shortened 40 minutes on the start, connecting with the Texas & Pacific at Terrell No effort will be made to make rapid time until the entire line has been rock ballasted. It is expected to open the line for passenger traffic on September 10 when the Midland will run a mammoth excursion to Paris, celebrating the advent of the line into this city.

West Virginia Central & Pittsburgh—On July 21 a heavy flood occurred on the Shavers Fork of Cheat river and on the Tygarts Valley river which overflowed a large portion of the West Virginia Central & Pittsburgh R., washing away a large amount of roadbed and some 15 trestles. On the 24th another heavy rainfall, raising the same streams and also the north branch of the Potomac river, more or less damage was again done all along the line of this road, but not sufficient in any place to delay trains after the waters receded. Trains were run through on the 25th. The total damage perhaps was not more than $10,000. The Dry Fork and Roaring Creek Rs. also suffered severely from same high waters. The former is not yet in operation.

Wilkesbarre & Northern.—This road which when finished will be 15 miles in length, is well under way. It is to run north from Luzerne to Harvey's Lake and tracklaying on a part of the line began Aug. 1. It is expected to lay six miles of track within 60 days and to lay five miles additional in the fall. Grading between Luzerne Borough and Dallas, in Luzerne county, Pa., has been finished, with the exception of a cut at Trucksville, four miles south of Dallas.

NEW ROADS AND PROJECTS.

Mexico.—The Sierra Madre Construction Co., which has just put up money to build that section of the Gulf, Rio Grande & Pacific from Juarez, through the Corralitas mining country to Guerero—about 400 miles—has started 100 head of horses and the paraphernalia of a large grading outfit from El Paso with the intention of beginning work as soon as possible. It is expected to complete this portion of the road by July, 1897.

Ohio.—The Cleveland & Southwestern R. Co., the organization of which was recently noted in this column, has a corps of surveyors in the field working at present eastward from Lima, Ohio. The route of the proposed road west of Lima toward Spencerville has been definitely located. The entire road will run from Cleveland to Indianapolis and through Elyria, Tiffin, Lima and Celina in Ohio, and Portland, Muncie and Anderson in Indiana. It parallels the Lake Erie & Western from Lima to Muncie, and is credited with being backed by the Cincinnati, Hamilton & Dayton in order to get a line into Cleveland in opposition to the Big Four and the Lake Erie & Western, because of Brice building the Lima Northern. Mr. Thomas H. Beer, of Bucyrus, O., is president.

A company has been incorporated at Columbus called the Northeastern R. Co. for the purpose of building and operating a railroad from a point on or near the north line of Euclid township, Cuyahoga county, thence through Lake, county and northeast. The incorporators are Frank S. Lyon, Charles N. Sheldon, Wm. D. Bennett, Gustave Runge and Lafayette Kimball. The headquarters of the new company will be at Cleveland.

Washington.—The contract for the Astoria & Columbia River road which is to be built between Astoria, Wash., and Goble, Ore., has been let to Honeyman & De Hart of Portland and they are rapidly sub-letting the work to contractors. It is said that within the next 10 days 800 men will be at work. The contract requires that the road shall be completed by May 1 of next year, and between now and the end of next winter there is some of the hardest work of putting in a mountain railroad to be done. The companys headquarters are being established at Rainier as the heaviest work is to be done in that vicinity.

INDUSTRIAL NOTES.

Cars and Locomotives.

—It is reported that the San Antonio & Aransas Pass Railroad Co. will erect railroad shops at Yoakum, Texas, to be 70x140 ft. M. D. Monserrate, manager, San Antonio.

—About 300 men at the United States Car Company's plant at Anniston, Ala., are out as a result of a strike by

the puddlers, heaters and rollers of the rolling mill department. The reasons given for the strike are that the company agreed to a new scale, and, while promising to pay it, declined to sign it for a definite length of time. Also, that 2 per cent of their wages is held back in the office as an insurance fund. All attempts to settle have failed, and the company has telegraphed cancellations of orders of about 1,000 tons of bar iron, which were wanted for immediate use.

—The Elliott Car Co. has commenced work on a large order of cars for the Florida Coast Line Railroad.

—The men in the Santa Fe Railroad shops at Argentine, Kan., have been notified that they would begin at once to work six full days a week.

—It is reported that the Chicago & Northwestern Ry. has let a contract for 1,000 box cars to Haskell & Barker.

Bridges.

—Bids for the construction of a new iron bridge, complete, across the North Canadian river upon the township line between range No. 6 and 6, will be received at the office of the county clerk of Canadian county Oklahoma until Aug. 15. The location of the bridge is within three miles of Yukon, which is a railway station.

—The proposed mammoth bridge over the Monongahela river, to be known as the Central bridge of McKeesport, will be built this year.

—An iron and steel bridge about 275 feet long will be constructed at Roanoke Rapids, N. C., to replace one recently destroyed by a freshet.

—Bids until August 25 will be received at Van Wert, Ohio, for the following iron bridges: One 60 ft. low truss bridge on stone; one 20 ft. low truss bridge on stone; one 22 ft. low truss bridge on legs, stone backing; one 25 ft. low truss bridge on legs, stone backing; one 28 ft. all steel joist on legs, stone backing.

—The long bridge over the Rock river beyond Jefferson Junction, Wisconsin was recently destroyed by fire. A new bridge will soon be built.

—The county and city authorities at Salt Lake City have decided to reject all bids on the Jordan bridge and advertise for new bids. The bridge is to be either iron or steel construction.

—At a late meeting of the board of county commissioners in Cincinnati, Engineer Krug submitted his estimate for the proposed bridge over the Little Miami river at Indian Hill. The total cost will be $101,705. which includes the extension asked for by the Pennsylvania Railroad.

Buildings.

—Bids will be opened August 10 for the erection of a depot at Galveston. Tex., after plans now on file with Engineer Felt of the Gulf, Colorado & Santa Fe Railroad.

—The Casey & Hedges Co. of Chattanooga, Tenn., will erect a large foundry as an addition to its boiler making plant at South Chattanooga. The foundry building with its equipment will cost $10,000, and will be ready for operation by October.

It is reported that the St. Louis & San Francisco Ry. will soon build both passenger and freight depots at Wichita, Kan.

—The South Carolina & Georgia Railroad Co. contemplates the remodeling and enlarging of a building at Charleston, S. C., originally constructed for a rice elevator, so as to change it into a modern grain elevator, with a storage capacity of about 200,000 bushels. The cost of the improvements will be about $10,000.

—The Grand Trunk Railway Co. some time ago arranged to concentrate its car building and car repairing shops west of Toronto at London, Ont. That city gives it a bonus of $100,000, and the agreement has been signed. Plans for the new shops will soon be ready, when tenders for the construction will be called for. They are to be equipped with a full line of up to date machinery.

—The new power house of the Chicago City Railway will be built on 49th street, between Oakley avenue and Leavitt street. The building will be two stories and basement high, constructed of brick, and will cost $250,000. Power will be furnished from the new plant for the electric lines in the southwest part of the city.

—The contract for the erection of a large machine shop for the Lloyd Booth Co., of Youngstown, has been awarded to the Youngstown Bridge Co. The shop will be of large size and will be complete in every detail.

—The Pittsburgh Bridge Co. is completing a head frame and tipple at Spring Valley, Ill. It has also taken the contract for a tipple to be erected at Mt. Pleasant, Pa., at the Moorwood shaft of the Southwest Connellsville Coke Co.

Iron and Steel.

—The Penn Bridge Company of Beaver Falls, has put on a night turn. This was found necessary in order to fill its many orders. The company now has in its employ nearly 400 men.

—The Franklin Steel Casting Company will double the capacity of its plant in all departments. It has orders ahead for 32,000 M. C. B. couplers, beside a large general casting trade.

—A Pittsburgh railway company has contracted with the Cambria Iron Company for 20,000 tons of light weight steel rails.

—The Carnegie Steel Company is filling two orders of 5,000 tons each for structural material for use in buildings in San Francisco. Other contracts reported are for 40 bridges for the Coahuilla Development Company, Mexo, and 30 narrow gage bridges on the island of Port au Prince.

—At the works of the Pennsylvania Steel Company, Steelton, Pa., the iron and steel foundries are crowded with orders. The bridge construction and machine department have many orders ahead, and the frog, switch and signal department is running with day and night turns.

—The Schoen Pressed Steel Company, which was reorganized from the Schoen Manufacturing Company last January, and the capital stock increased to $100,000, contemplates extensive improvements at its plant.

—A proposition has been made to the citizens of Frankfort, Ind., by G. M. Roberts of Cincinnati, O., offering to remove the Cincinnati Steel Company to that point if they will donate three acres of land and $10,000 to the company, of which he is a member.

—The American Steel Foundry at Granite City, Ill., is working with a full force of hands. The company has orders enough to keep the works busy for a long time.

Machinery and Tools.

—Norton Eemery Wheel Co., Worcester, Mass., manufacturer of emery wheels and general grinding machinery, reports a large increase in its business, the gain for the first half of 1896 being about 40 per cent. The addition to this concern's plant is progressing and when completed will increase its facilities fully 50 per cent. A new line of grinding machinery is also in preparation.

—It may not be generally known that the largest and most powerful steam shovel ever built in this or any other country, is now at work loading ore in the Oliver mines. The machine was built by the Vulcan Iron Works, Toledo, Ohio, upon a guarantee to load 4.000 tons of ore in ten hours with proper car service, and to dig it without being blasted. The shovel weighs 90 tons, has engines of 190 horse power, carries a dipper holding 2¼ cubic yards, or five tons of ore, and is mounted on extra heavy railroad car trucks of standard gage. The shovel is now loading 25 ton ore cars at the rate of one car in two minutes, or 20 cars an hour. Owing to delays in shifting cars much time is lost, but with proper car service this shovel will easily load 200 cars in ten hours, or more than 5,000 tons.

—The New England Machine Co. gives notice that the company has been reorganized and more fully equipped for the business of buying, selling, or exchanging new and second hand machinery and all kinds of mill and machinery supplies, at the old stand, 45 and 47 Beverly St., Boston. It announces that it has in stock at present time and will continue to carry large lines of new and second hand machinery of every description, all of which it will sell with guarantee of entire satisfaction, and at extremely low prices.

—Quite in contrast with the general dullness is the unusual activity displayed at the works of the Link-Belt Machinery Co., Chicago, which has been operating its machine shop with two gangs of men day and night during the past three months. The foundry as well is being worked to its limit, one order for castings alone requiring 987,000 lbs. of iron. A notable order is one for furnishing the Chicago Sugar Refinery, Chicago, with complete equipment of machinery for handling coal from cars to iron bins located in power house over 25 B. & W. Boilers. From bins whose storage capacity is 650 tons, the coal is spouted directly into chain grates in boilers. Another order for Huron Iron Co., Michigan, for two 8 ft. spirally grooved hoisting drums, together with 11½ in. x 25 ft. shaft, friction clutches, base plate, etc., and brake bands for running the drums independent of each other, both for hoisting and lowering, is nearing completion. The two friction clutches and brake bands are so arranged that they can be operated by one man without moving from one place to another, the operating mechanism being brought to center of frame.

—The Crippen Manufacturing Co. has been incorporated at Athens with a capital stock of $100,000. This company will manufacture the Crippen compound car pusher. The officers of the corporation are: T. D. Dale, president, Marietta, O.; H.M. Crippen, general superintendent, Athens, O.; Wm. Nicholas, vice president, Philadelphia, Pa., and Hon. C. S. Dana, Marietta, O.

—Large additions will shortly be made to the shops of the Pennsylvania Railroad, at Altoona, Pa. Plans for these additions have already been prepared and work will be commenced at once. The blacksmith shop will be enlarged by a 225x68 ft. addition, and the boiler shop will be remodeled and its capacity for turning out work will be increased. The walls of the boiler house have already been raised 20 ft., so as to provide for more modern machinery. The removal of the cranes from the erecting shops to the boiler shop, and the substitution of more up-to-date cranes in the erecting shop is among the changes contemplated, and the building modified to suit the new plans of the company. Hereafter all locomotives for the Pennsylvania Railroad and the Pennsylvania lines west of Pittsburgh will be built at Altoona and only repair work will be done at the other shops. The rapid growth of the system and its traffic make necessary the many changes and improvements at the great central shops, and they are destined to become in the near future the largest and most important in the world.

—The annual meeting of the stockholders of the Westinghouse Machine Co. was held on Thursday last. The reports of the officers, considering the depressed condition of business during the last year, were considered gratifying. The following directors were elected: Geo. Westinghouse, Jr., H. H. Westinghouse, John Caldwell, John R. McGinley and E. E. Keller. The board has not organized, but it is stated the same executive officers will be elected as follows: President, Geo. Westinghouse, Jr.; vice president, E. E. Keller; secretary-treasurer, T. L. Brown; assistant, F. M. Garland.

Miscellaneous.

—The New Orleans & Western Railroad will advertise for bids on the construction of 200 or more feet of wharf age at New Orleans.

—The strike at Fernandina, Fla., between the Florida Central & Peninsular Railroad and the machinists boiler makers and blacksmiths, has been settled. It is said that the demands of the men were allowed, but details are not known.

—The Peninsular Construction Co., Baltimore, Md., will be in the market within the next sixty days for about 2,700 tons of 60 lb. steel rails, Pennsylvania Railroad standard. Contracts will also be let within the next sixty days for grading and other work on twenty-five miles of railway.

—The Crane Co., of Chicago, has recently increased its capital stock from $3,000,000 to $4,000,000.

—The loss of the different plants in and near McKeesport, Pa., caused by the high waters will probably reach $200,000. A large portion of the Dewees Wood Co.'s plant was under water and thousands of dollars worth of sheet iron and machinery destroyed, while a number of the furnaces are beyond repair.

—Ellsworth, Morris & Co., one of the largest coal operating concerns in Ohio, has decided to cut its coal by lectrical machinery. The three-phase system of the General Electric Co. will be employed, and the plant will consist of one 135 h. p. electric generator and eight coal cutters of the new induction motor chain type. These will be placed in two mines at Trail Run and Hartford, Ohio, distant from each other 2½ miles. The power house will be located centrally and the current will be carried for nearly 2 miles, over aerial wires, which will be through drill holes into the entries of the mines and be carried to the various points where the cutters are employed. Induction motor cutters are adopted in place of the direct current motor cutters for the reason that the former are lighter in make, possess many characteristics that make that method of applying power to the cutter superior, decrease the amount of copper required to equip the mine, have no commutator or brushes demanding constant attention, have no starting rheostat and do not spark. The operator is not called upon to devote part of his time to attending to a brush and commutator mechanism, but can continue his work uninterruptedly. The Hudson Coal Co., owning and operating coal mines at Deerfield, Portage county, Ohio, has also adopted electrical apparatus for cutting its coal. The plant consists of a 100 h. p. three-phase generator and a 6 ft. coal cutter. The mine in which the cutter is working has just been opened. The entry is driven in only a few hundred feet and there is only room at present for one cutting machine.

—Mr. Oliver Downing, general agent of the Union Grease Co. of Boston, sends a letter from Mr. Geo. S. Mackinnon, master mechanic of the Canadian Pacific Railway at Toronto, which states that "One of our 10 wheeled passenger engines No. 555, running between Montreal and Smith's Falls, used Union grease in side rods and big ends, and from November 1 to December 2 made 5,216 miles with 1½ lbs. of the grease and gave good satisfaction, there not being any trouble whatever with its running." This letter speaks well of the product of this company, both as to satisfactory lubrication and economy in consumption of the lubricant. It will probably be remembered that the special claims made for this unguent are that it possesses great adhesion and will stick to metallic surfaces while it is almost devoid of cohesion among its own particles. Mr. Downing says that this grease will feed with a spindle leaving a shoulder having 1-64 in. of feed with a 1-16 in. lift. It is also able to withstand heat and cold without being affected, and it does not wash off with water, either fresh or salt. Realizing that conditions vary in different machines, and that various kinds of service require different lubricants. Union grease is now furnished in several grades which are specially adapted to the various uses to which grease lubricants are put.

—Another excellent report of coupler tests has been received from the Whiteley Malleable Castings Company, Muncie, Ind. These tests were made upon "American" couplers by Mr. H. S. Bowen, representing R. W. Hunt & Company, Chicago. For lack of time only six bars were tested to destruction and the others were given the test of the Master Car Builders' Association which is 3 blows at 10 ft. and 2 blows at 15 ft. with a 1640 lb. hammer. Several bars, however, were given one or two extra blows. The record of the tests is as follows:

Bar No. 1, 3 blows at 10 ft., 6 blows at 15 ft., bar bent in stem, otherwise bar O.K.
Bar No. 2, 3 blows at 10 ft., 8 blows at 15 ft., stem bent, knuckle is not operative, otherwise O. K.
Bar No. 3, 3 blows at 10 ft., 7 blows at 15 ft., stem bent, bar not broken.
Bar No. 4, 3 blows at 10 ft., 5 blows at 15 ft., bar broken at buffer stop. Fracture good.
Bar No. 5, 3 blows at 10 ft., 7 blows at 15 ft., bar bent and slight crack in head. Knuckle broken.
Bar No. 6, 3 blows at 10 ft., 9 blows at 15 ft., bar broken in stem. Fracture good.
Bar No. 7, 3 blows at 10 ft., 5 blows at 15 ft., fracture shows hot crack in stem.
Bar No. 8, 3 blows at 10 ft., 4 blows at 15 ft., bar O. K.
Bar No. 9, 3 blows at 10 ft., 4 blows at 15 ft., stem bent, otherwise bar O. K.
Bar No. 10, 3 blows at 10 ft., 4 blows at 15 ft., knuckle broke.
Bar No. 11, 3 blows at 10 ft., 5 blows at 15 ft., bar cracked in back wall otherwise bar O. K.
Bar No. 12, 3 blows at 10 ft.. 4 blows at 15 ft., knuckle closed down on face of contour line, otherwise bar O. K.
Bar No. 13, 3 blows at 10 ft., 3 blows at 15 ft., stem bent, otherwise bar O.K.
Bar No. 14, 3 blows at 10 ft., 3 blows at 15 ft., stem bent, otherwise bar O. K.